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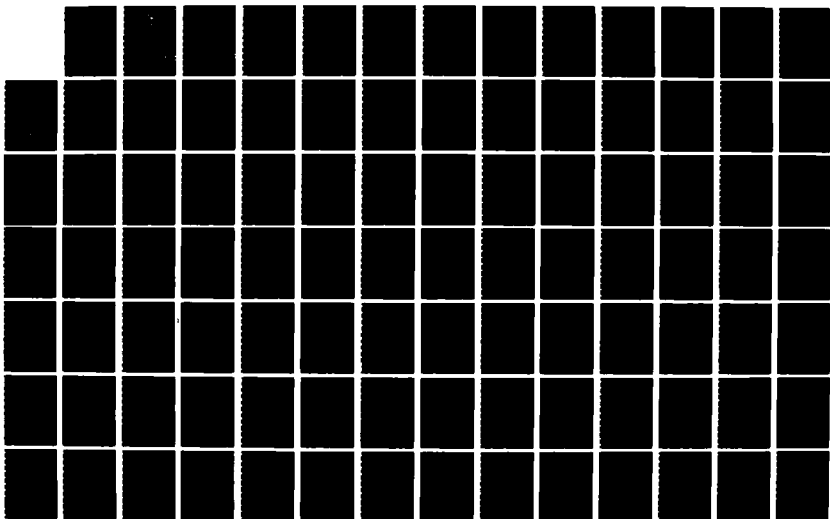
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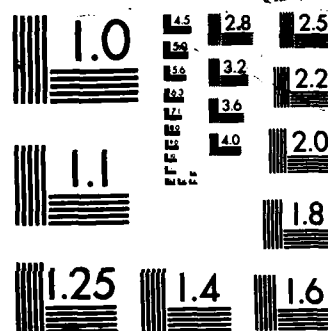
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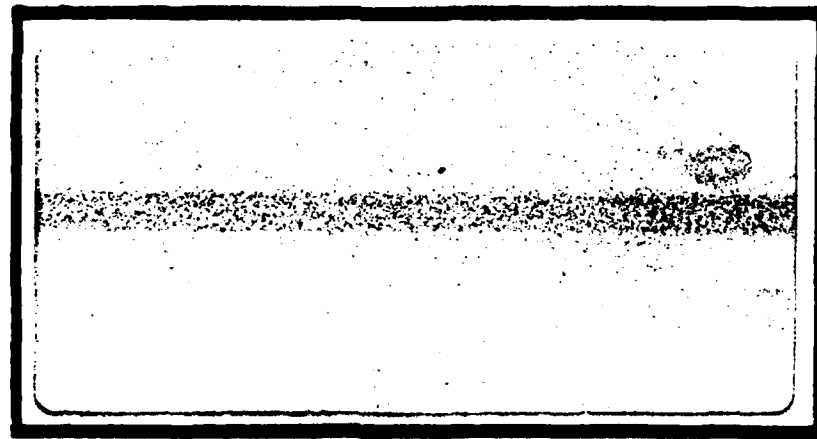
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THE PROPOSED GENERIC
INFORMATION SYSTEMS PLANNING MODEL
THESIS

Lai Kim-Fatt, B.E.
Major, Republic of Singapore Air Force

AFIT/GSM/LSY/86S-12

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**THE PROPOSED GENERIC
INFORMATION SYSTEMS PLANNING MODEL**

THESIS

**Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology**

Air University

**In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Systems Management**

Lai Kim-Fatt, B.E.

Major, Republic of Singapore Air Force

September 1986

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Preface

The purpose of this thesis report is to propose a generic information systems planning model by synthesizing various planning methodologies currently in use. The results of this report should provide a basic framework for any kind of organization to use to develop its own information systems planning methodology.

Throughout this thesis research, I have received much support from many people in the Institute. I would like to thank especially my faculty advisor, Captain Thomas Triscari, Jr. for his valuable advice and time devoted to this report. I would also like to thank Mr. Samuel Epstein for his assistance in computer matters. Finally, I wish to thank my wife, Theng-Theng and son Junxu for their support and understanding during my stay in the Air Force Institute of Technology as without these, this thesis report could not have been completed so smoothly.

Lai Kim-Fatt

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Abstract

The need for a better information systems planning methodology for use in the Republic of Singapore Air Force prompted this thesis effort.

This thesis report focuses on the development of a generic information systems planning model that is applicable to different organizations. Such a model is being developed by reviewing in detail, seven different information systems planning methodologies commonly used at present by many government and business organizations and thereafter, synthesizing them based on some selection criteria. The later part of this report documents details of each of the fourteen planning steps in the proposed generic information systems planning model. The potential advantages, disadvantages and possible applications of ~~the~~ this model are addressed and documented.

The thesis report is concluded by recommending possible field testings and future research to further enhance and refine the proposed generic model. It is hoped that a better and more complete information systems planning methodology for the Republic of Singapore Air Force can be developed from the proposed generic model to ensure a compatible and integrated information systems network for the Republic of Singapore Air Force in the near future.

THE PROPOSED GENERIC INFORMATION SYSTEMS PLANNING MODEL

I. Introduction

General Issue

Over the last seven years, the Republic of Singapore Air Force had developed more than ten large management information systems to support its logistics and manpower operations. The concurrent and piecemeal implementation of these systems had, however, led to duplication of information among some of the related systems, resulting in their incompatibility and inconsistency.

In line with the computerization efforts of the Republic of Singapore Air Force, more and more non-computerized functional areas such as the Intelligence Units and Flying Wings, are or will be submitting their requests for acquisition and development of management information systems to Air Staff of the Republic of Singapore Air Force for approval. Therefore, there is an urgent need for management to develop a better and an integrated information systems planning methodology as well as consistent guidelines to be followed across the entire organization so as to ensure compatibility and completeness in the future acquisitions and development of management information systems within the Republic of Singapore Air Force.

Background

Technological advances made in the development of electronic devices and computer related equipment have continued to push down the cost of computer hardware. In contrast, the software cost (cost spent on software development and software maintenance) is increasing. According to Boehm, the software cost in a project is now constituting a greater portion of the entire project cost as compared to hardware cost. The percentage ratio of hardware versus software cost has changed from about 80% versus 20% in 1955 to the present ratio of about 15% versus 85% (1; 57). A pictorial view of this trend of hardware vs software cost which is shown in Figure 1 presents a better picture for understanding this.

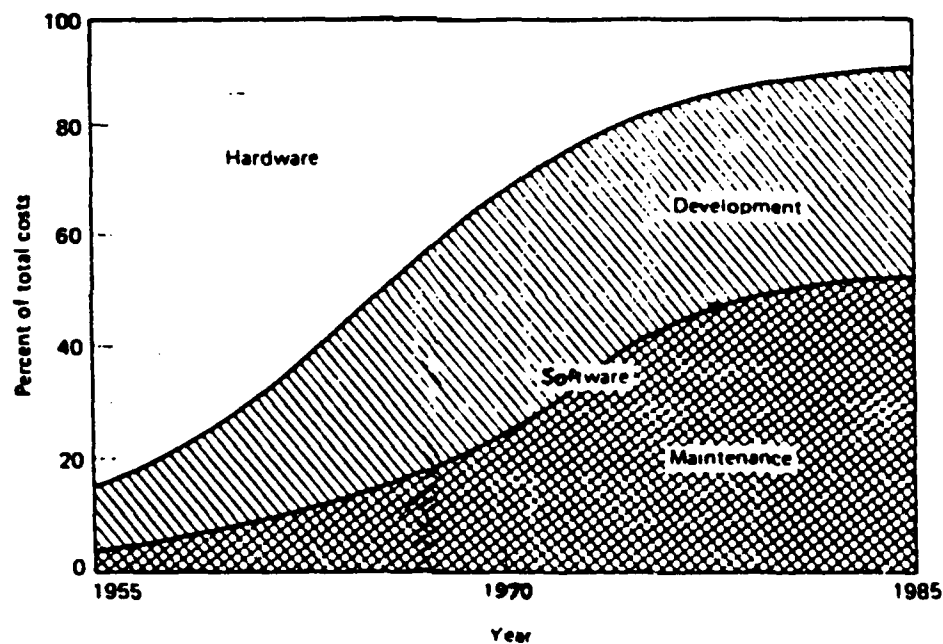


Figure 1. Trend of Hardware vs. Software Cost [1:3]

To take advantage of the trend of decreasing hardware cost and to improve productivity of its various functional areas, the Republic of Singapore Air Force has embarked on a massive computerization exercise. However, due to lack of proper information systems planning, the problem of incompatibility among some of the related systems has arisen. To tackle this problem and in view of the trend of increasing software cost, the Systems and Computer Organization of the Ministry of Defense, Singapore has packaged a software planning methodology called "Information Systems Planning Methodology" in 1983 (53). This planning methodology was packaged for use in all subsequent software development projects in the Republic of Singapore Air Force. However, it is still lacking in some aspects and does not provide a complete mechanism to ensure that all the needed information is captured for computerization purposes and that related systems are compatible.

To solve these problems, the Republic of Singapore Air Force will need to improve its existing information systems planning methodology and develop a complete and detailed long-term information systems development master plan. Such a master plan will assist management in deciding on the implementation priority of future requests for acquisitions and development of information systems submitted by the various functional areas.

Specific Research Problem

To aid the Republic of Singapore Air Force management to find an effective solution to their problem of incompatibility among related computer systems and to develop a complete long-term information systems master plan, it is necessary to examine the current information systems planning methodologies available in the market and derive a generic information systems planning model that is generally applicable to different kinds of organizations. A better and more complete information systems planning methodology for the Republic of Singapore Air Force can then be developed from this generic planning model in order to create a compatible and integrated information systems network for the Republic of Singapore Air Force.

Investigative Questions

To solve the specific problem stated above, the following investigative questions will have to be answered.

1. What are the current developments in information systems planning methodologies in general?
2. What are the similarities and differences among the various information systems planning methodologies that are currently in use?
3. What is the existing information systems planning methodology used by the Republic of Singapore Air Force?

4. What are the potential pitfalls of the existing planning methodology?
5. What are the necessary steps that should be included in the generic information systems planning methodology?
6. What is an effective way to justify and demonstrate the relative advantages of the proposed generic information systems planning methodology?

Scope of Research

This research focuses only on the derivation of a generic information systems planning model that is generally applicable to different kinds of organizations by examining the various planning methodologies currently in use. It covers in detail seven different information systems planning methodologies. By comparing and consolidating all the relevant and effective planning steps from these methodologies, a generic information systems planning model is derived. The details of each of the planning steps in the generic information systems planning model and the applicability of this model are addressed and documented in this report.

This research did not cover all the possible improvements required by different kinds of organizations. It also did not look into the possible improvements which would be needed to be incorporated into the existing

information systems planning methodology used in the Republic of Singapore Air Force. Rather, it recommended that a future follow-up study be conducted so as to identify the potential areas of improvements by comparing the generic information systems planning methodology and the existing information systems planning methodology used in the Republic of Singapore Air Force.

Operational Definitions

Definitions of significant terms as used in the context of this report are explained as follows.

Information and Data. The terms information and data are often used inter-changeably in many non-MIS literatures. In this report, information is defined as the summarized or processed data that is meaningful or useful to those who received it (9:9,200). The term data, on the other hand, is the non-processed, non-evaluated raw material for producing information (9:9).

System. This term is too loosely defined and used in many literatures. Webster's Dictionary provides no less than eight definitions of this term. For the purpose of this report which is to develop a generic information systems planning model, a system is defined as a collection of elements which are related and linked together to process input and accomplish some tangible and meaningful objectives (output) as shown in Figure 2.

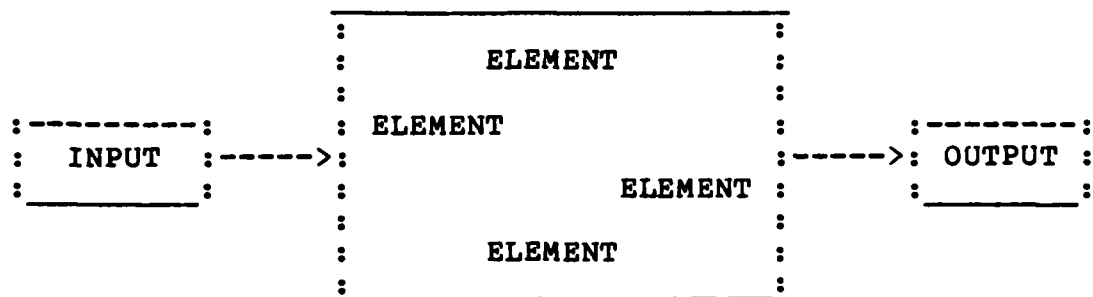


Figure 2. System and its Components

Information Systems. The term information systems which is used inter-changeably throughout this report with management information systems (MIS), refers to all the computer-based information processing systems developed to support all kinds of users' functions in an organization, such as routine operations, management control and decision making. According to Davis, information systems make use of "computer hardware and software, manual procedures, model for analysis, planning, control and decision making, and a database" (9:6).

Compatibility. This term as used in the specific research question refers to the ability of different computer-based information systems to communicate with and transfer information to one another electronically.

Integrated Information Systems Network. This refers to a computer network that consists of closely linked and compatible information systems which share common data

bases, computer and communication equipment to a large extent. It has relatively high degree of coordination and consistency between interacting systems and has the following characteristics (17).

1. Data availability
2. Consolidated data
3. Consolidation of closely connected activities
4. High degree of resource sharing

Information Systems Planning. This refers to the systematic concepts and methodologies used in planning and identifying an organization's information systems requirements and for guiding subsequent developments of information systems. In this report, this term is being used inter-changeably with the term "MIS planning". It covers all the contents and meanings of the commonly used planning terms such as "MIS Strategic Planning" used by King (27:27; 30:303); "Strategic MIS Planning", "Long-range MIS Planning", "Medium-range MIS Planning" and "Short-range MIS Planning" used by Mclean and Soden (37:23,26); and other terms such as long-term planning for information systems.

Strategy. This term when used in the military sense refers to the "large-scale planning and directing of operations during both wartime and peacetime. When used in a business organization, it refers to the broad, overall deployment of the organization's resources to achieve stated objectives" (54:194). It represents some selection of

courses of action (or approaches) and the allocation of resources to achieve stated objectives.

Strategic Planning. Strategic planning which is occasionally cited in this report refers to the process of determining and deciding on the organizational mission and objectives, the resources required to achieve these objectives and the policies govern the purchase, allocation, use and disposition of resources (24).

Methodology. This is not synonymous with methods and tools. Whereas methods are merely the ways of doing things, and tools are the things that help to implement the methods, Methodology refers to "a set of methods or tools that are combined with an overriding management control and procedure" (57).

Goal and Objective. These terms have been used interchangeably by many authors. In this report, goal is considered to be of a general nature, of longer perspective and covers a larger scope than objective although their basic meaning remains very much similar to each other.

Mission. This term refers to the broad statement on the reason(s) for existence and the purpose(s) of an organization. Goal and objective are the statements on the things that are to be achieved by the organization in order to achieve the organizational mission.

Database. According to many authors, database is the heart of or central to a MIS (8; 9:502; 17:434). It is a

"mechanized, formally defined, centrally controlled collection of data in an organization" (9:502). For the purpose of this paper, it is being used as a centralized collection of data files or records which contain basic data and reside in a MIS. It facilitates sharing of data by different organizational sub-units through systems and application programs to satisfy users' day-to-day information needs (17:436).

Database Management System (DBMS). A firm-ware (system software that are developed by vendor and come with the computer system) that facilitates the initial definition and creation of data, and the subsequent data usage by users and programs such as retrieval, storing and updating (8:1-8).

Data Model. "A data model is a model describing the data in an organization. It provides a framework for abstracting the essential qualities or characteristics of data " (9:507). It is an effective tool to depict data entities and the relationships among them (53). It is used by the information systems users to specify their information requirements, and by the information systems developers to design the logical data bases which can be easily transformed into data bases on any DBMS.

Data Modeling. Data modeling is the process of abstraction and documentation using a data model (9:507). It is an effective tool to depict data entities and the

relations among them (53). It is commonly used by information systems users to specify their information requirements and by information systems developers to design the logical databases which can easily be transformed into databases on any DBMS.

Data Entity. This is any type of tangible or intangible objects (such as employee name, education qualification etc.) about which information is maintained (10; 53). It is "a category arbitrarily defined so that membership within the category can be established " (9:508).

Data Attribute. This is the basic data element in each of the data entity to describe the contents and characteristics of that particular data entity (9:508; 10; 24; 53).

Data Dictionary. According to Davis and others, a data dictionary is "a repository of information about data" (9:505). It is a tool used mainly by data administrators to capture information on the data environment of an organization (10; 53). This environment must provide information on the following.

1. The data contents represented by the relational data models
2. The data definition and properties of each data entities and attributes in the data models
3. The data security controls of the information systems

Data Flow Diagram. This is "a graphic method for defining inputs, processes, and outputs and for factoring systems into subsystems" (9:487,580). It is an effective tool to depict the relationships between data, activities and users (53). It is used by information systems professionals to package the functional requirements of users and walk-through with them to discover errors, if any. Therefore, it is a top-down input-process-output approach or tool for evolutionary approach to information systems design and development.

II. Literature Review

Introduction

With the growing investments in computer-based management information systems (MIS) and the continuing breakthroughs in the area of computer technology, more and more organizations are putting greater emphasis on the planning of their information systems requirements and developments (12:26; 52:28). These organizations do so because they realize the fact that the organizational benefits realized from computer based information systems are increasing at accelerating rates (30:299). According to Buchanan, "Information Systems can support an organizational structure by strengthening communication lines and clarifying measures of performance" (3:144). In addition, King also noted that "the information systems function will become comparative advantages for some organizations (those that manage information well) and not for others (those that do not)" (30:299). This literature review documents the findings and views on the topic of information systems planning by MIS experts, as listed in the bibliography, with emphasis on the following nine areas.

1. Importance of information systems planning
2. Relationships between information systems planning and organization's strategic planning
3. Three stage model of information systems

planning developed by Bowman, Davis and Wetherbe
(2:11-25; 9:455-456)

4. Different information systems planning methodologies
5. Important considerations for implementing information systems planning studies
6. Possible benefits that can be derived from the conduct of an information systems planning study
7. Problems faced in information systems planning studies
8. Pitfalls of the existing information systems planning methodology used in the Republic of Singapore Air Force
9. Future developments of information systems planning

This review gives details of each of the available information systems planning methodologies in practice. A more complete and objective information systems planning model which is representative and applicable to different organizations is developed based on the findings of this review. The MIS experts' findings and views are mostly summarized and occasionally quoted directly from the sources listed in the bibliography of this thesis.

Historical Development

A brief history of how the information systems planning evolved to the current stage will give readers a better understanding of the entire picture of information systems planning. During the early 70's, some of the leading MIS researchers, such as Clarke (5) and Murdick and others (42), became aware that there was a serious need to develop more structured and measurable planning methodologies to help both the users and the information systems professionals to have a better grasp of the potential problems that they could face in their information systems developments (5; 42). Also, during this period, there was a conceptual change in the information systems professionals' roles, from the main designers of information systems to the less dominant facilitators assisting users in identifying their information needs and business problems (43). This was a natural development because it is the users who know their business better than anyone else, including the best and most experienced information systems professionals. To perform these new roles effectively, the information systems professionals required a different set of skills and tools than those traditionally used by them in their systems designs. This critical requirement caused several MIS researchers to concentrate their efforts on the development of new and effective information systems planning concepts and methodologies.

Problem

The search for suitable and systematic ways of planning the information systems developments became even more critical in the late 70's after many failures in the delivery of information systems occurred (52; 53). It was common to find MIS projects that were inadequately designed. More seriously, some recently developed systems were abandoned totally because of the long lead time and other key resources involved in changing the systems (1; 5:8; 22:36; 6:31). As rightfully pointed out by Cohn (6:31) and Litecky (31:36), many existing information systems in large and dynamic corporations cannot communicate with one another, and generating management reports from these systems which are termed by Ross as "the islands of mechanization" (49:202) can be a tedious job.

Why did such things happen? Was it because the information systems professionals involved were not capable enough? Or was it because users were not interested or committed? On this, Hoole concluded as follows:

Some of the reasons typically cited include poor design, implementation difficulty and the lack of user support and involvement. These problems, however, are merely symptoms of the root cause, ineffective systems planning. Proper planning is the first and most important step toward system success [22:36].

King reported that most of the previous attention given to management information systems were on the implementation details of specific information systems (30:301). With the current new information era, he felt

that more concerns and increasing attention have been given to "higher-levels" of information management (such as strategic planning for information systems and information systems master planning etc.) by both organizations and MIS researchers (30:301).

Review Findings

Planning is a continuing organizational function that is necessary and critical to for subsequent management functions such as operation control, organizing and decision making. It is an uncertainty reduction process which has to be followed by a good controlling and updating functions that an organization has to perform in order to direct effort and resources toward common organizational goals. In one of their management books, Mescon and others define planning as "the process of selecting objectives and deciding what should be done to attain it" (38:204). Tripp and Wahi (55:7) agreed to this definition as well. However, for the purpose of this thesis, in addition to those defined above, planning should include the following four factors as advocated by Said and Seiler (50:25).

1. The completeness and flexibility of the planning process and the final plan in coping with changes
2. The consistency of the planning emphasis with organization's strategies, goals, objectives and resource requirements

3. The continuity of the planning process as a regular and formal activities
4. The degree of emphasis given to strategies and creativeness

The following nine sub-headings cover the most commonly addressed issues on information systems planning, namely the importance of information systems planning, relationships between information systems planning and organization's strategic planning, the three stage model of information systems planning, different information systems planning approaches, important considerations in implementing information systems planning studies, its potential benefits and pitfalls, problems faced in information systems planning studies and its future development.

Since information systems function may "influence organizational capability, productivity and effectiveness" (30:299) dramatically, the planning of this key organizational resource (ie. information) may also have some influence on organization's performance. The information systems planning has to directly relate to and in support of the organization's strategic plans and strategies (27; 35; 48; 51; 54; 57). As a result, most of the MIS authors have discussed this issue in line with the strategic planning and corporate objectives and strategies of the organization concerned (15:1631; 52).

Importance of Information Systems Planning. According to Davis and others, an information systems plan is "the first step in integration of diverse information systems applications" (9:8). Information systems plan can guide and coordinate the analysis, design and implementation of different application systems and ensure certain degree of compatibility and consistency among them. As stated earlier, planning is an important organizational function for management at all levels, however, it is always being neglected (9:303). Despite the increasing number of information systems implementation failures, information systems planning is still being treated lightly by some corporations (52:28). The importance of information systems planning was not realized until the early 80's (12:26). The following comments made by Clarke in his article published in the Journal of Systems Management, further supported this view.

Top management realizes the importance of long range planning in determining the future position of the company. However, this understanding has not included the EDP [electronic data processing] functions. Many top managers today look upon EDP as a necessary evil and fail to consider the impact of the large investments in data processing men and equipment [5:8].

The reasons that planning is being neglected or not being given enough attention by various organizations can be summarized to the following four more important points.

1. Planning is a tedious and time-consuming cognitive activities to perform (9:304)

2. It requires a lot of effort and time and most managers have problems getting time to involve in planning (9:304)
3. Plans made are often disregarded by management and staff and this discourage people to involve in planning in future (9:304)
4. Organization does not have the necessary conditions and suitable environment to encourage and support planning activities (53)

However, some of the latest MIS articles revealed that information systems planning was gaining more and more recognition in most of the large corporations and government agencies (12:26; 53). In her article titled "Getting the Big Project Off the Ground", Johndrow articulated that information systems planning is important in getting a large project off the ground and in ensuring that the project is moving in the right direction (25:37). Since information is considered by many MIS authors as a key organizational resource (30:300) because it helps to reduce the level of uncertainty faced by management and the organization and hence makes possible a more effective decision making and a better organization performance (9:200-277). Information systems planning is the planning of management and processing of this key resource -- information and therefore should logically be considered as an integral part of an organization's strategic or long range planning. It will

have to support and complement the organizational objectives (or mission in military cases) and the forecasted needs of the organization concerned (31:36,38; 22:36; 3:144; 9:8). Information systems planning is becoming increasingly necessary and important in view of the increasing complexity, cost and development time of computer based information systems and the increasing importance of these systems to the success of the overall organization (37:76-77). Its importance will be realized by more and more organizations in time to come due to the following four special reasons as suggested by Murdick and others.

1. To offset uncertainty
 2. To improve economy of operations
 3. To focus on objectives
 4. To provide a device for control of operation
- [42:247,248]

Relationships Between Information Systems Planning and Organization's Strategic Planning. The overall organizational plan of an organization is important and required by the information systems planning study (20:7). It provides a basic foundation on which the information systems plan is being developed. The goals, objectives, and strategies developed for information systems should be derived from the organization's goals, objectives and strategies and by doing so, it can ensure a higher possibility that the information systems goals, objectives and strategies will be consistent with and in support of

that of the organization's (4:119).

Like any other type of planning, information systems planning should commence with sound , clear and precise statements of goals, objectives and strategies since the entire planning process may later on be affected and constrained by these statements and the availability of organizational resources. Therefore, ideally and in general, information systems planning should be carried out in a top-down fashion that is being guided by the organization's goals, objectives and strategies.

However, conditions for information systems planning to be performed in a top-down manner are not always satisfied. Where an organizational (or business) plan is not available or has not been developed or constantly updated, Head suggested that "systems planners must take a bottom-up approach" (20:7). They have to conduct interviews or other forms of dialogue with the top management, the functional managers and the systems specialists in order to identify information systems goals, objectives and strategies based on the assumptions they have formulated about the organizational (business) strategies. The systems planners in this case is required to confirm their proposed planning assumptions and information systems goals, objectives with the top management before moving on to next planning task.

The absence of a formal organizational (corporate or business) plan for the overall organization will create

significant difficulties for the information systems planning efforts. However, this should not prevent the systems planners from carrying out the information systems planning so that a master plan can be formulated to guide and coordinate all future information systems activities within the organization (37:77).

When interactions between the top management and the systems planners are not possible or simply not productive, information systems planning "may have to be abandoned or carried out without benefits of top management guidance" (20:8). This is especially true and commonly seen in cases where the information systems planning is done for the computerization of a relatively non-critical and low-level functional area which has no or little impact to the overall performance of the organization.

Three Stage Model of Information Systems Planning by Bowman, Davis and Wetherbe (2:11-25; 9:455-456). This three stage model identifies and clarifies the high-level generic planning activities/processes that are needed to be considered in developing a long-range information systems master plan. It also specifies the sequence of the planning activities and the various alternative techniques and tools that planners can use to help them to perform their planning tasks easier as shown in Figure 3. Therefore, this model warrants discussion separately as a sub-heading as it will be used as a base for deriving a generic information systems planning model in this thesis.

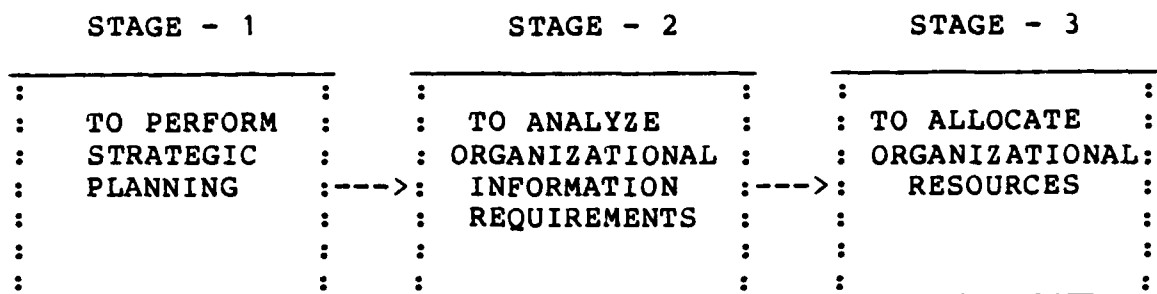


Figure 3. Three Stage Model of the Information Systems Planning Process [2:11-25; 9:455-456]

A salient feature of this model is that it presents a better "insight into the various planning processes and reduces confusions as to the position of competing planning methodologies" (9:456). It also describes the stages of planning and the role of methodologies in strategic planning, organizational information requirements analysis and resource allocation. The three stages included in this model are given in greater detail as follows.

1. To perform strategic planning

In this stage, the planners has to identify and define the information systems objectives, goals and strategies from the organization's objectives, goals and strategies so that they are consistent with and support those of the organization. The four alternatives methodologies identified for use in this stage are as follows (9:456-460).

- (1) Derivation of information systems' objectives, goals and strategies from the organizational mission, goals and objectives

This alternative methodology assumes that the organization has already have its objectives, goals and strategies well defined in an organizational plan and hence the objectives, goals and strategies for information systems can be easily derived from this organizational plan. Organizations which do not have an updated organizational plan in existence may have to use one or combination of the other three alternatives to be discussed below.

(2) Mcfarlan-Mckenney strategic grid (9:457; 34:15)

This strategic grid, as shown in Figure 4, covers four square boxes representing four different position of information systems activities "support, factory, strategic and turnaround" relative to the two axes or basis namely "the strategic impact of the portfolio of applications planned for development and the strategic impact of the existing information systems applications portfolio" (9:457). It can be used by information systems planners to estimate and gain an overall picture of the general strategic position of information systems (34). However, it is not sufficient to be used alone for developing an information systems goals and strategies. It has to be used with other alternative tools in order to obtain a complete final product i.e. the information systems goals and strategies.

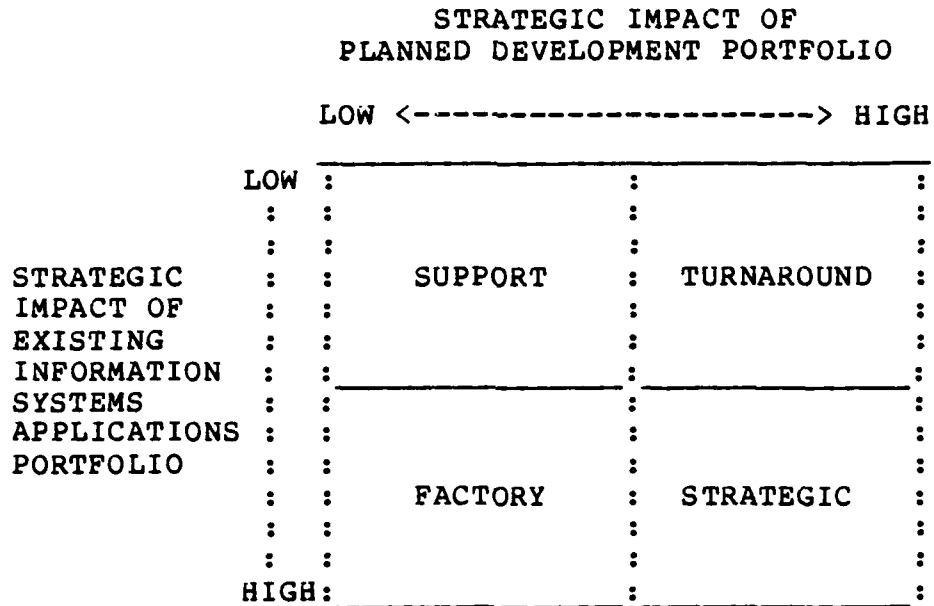


Figure 4. The Strategic Grid [34:15]

(3) Strategic fit with organizational culture
(9:458-459)

This alternative tool can be used to analyze the overall organizational culture and hence help the information planners to gain a better understanding of the general values, thinking and directions of the organization. Like the strategic grid tool, this strategic fit tool is not a complete tool that can be used alone to develop the information systems goals and strategies (9:459). The central theme of this tool is that the goals and strategies for information systems should fit with the organizational culture so that there will not be any violent objections and resistance from all levels of staff which can cause the entire information systems planning effort to fail.

(4) Strategic set transformation (9:459; 27:27-37)

This is a relatively more complete tool for producing the information systems goals and strategies as compared to the other three alternatives discussed above. It comprises the following steps outlined below.

- a. Describe, analyze and identify the organization's strategy set by explaining organization's structure, identifying sub-units' goals and the organizational goals and strategies for these sub-units.
- b. Counter-check the organizational goals and strategies with management for correctness and relevance.
- c. Transform the organization's strategy set into information systems strategy set using the three steps discussed below.
 - i. Identify all the relevant information systems goals for each of the organizational goals and strategies.
 - ii. Derive information systems constraints from organization's strategy set and from information systems goals obtained in step-i.
 - iii. Derive and develop information systems design strategies from the information systems goals and constraints identified

in step-ii above.

- (5) Framework for identifying organizational and information system characteristics by Yadav (58:42)

This framework which helps the information systems planners and system analysts "in identifying organizational characteristics and matching information system requirements" (58:41). This framework consists of the following five steps.

- Step 1 Do an aggregate structural analysis, describing
 - a. organizational missions and goals
 - b. the operating core
 - c. the structural configuration
- Step 2 Do a broad functional analysis, describing
 - a. the major functional organizational strategies, goals, and measures of performance
 - b. the functional structure
 - c. major organizational systems used for integration
- Step 3 Do a detailed analysis of the organizational functions being supported by the information system, describing
 - a. the function goals and measures of effectiveness for functions to be supported by the information systems
 - b. the sub-functional units and structures
 - c. describe the functional systems
- Step 4 Analyze the managerial functions to be supported by the information system, describing
 - a. the broad categories of managerial activities
 - b. the actions to be supported under each managerial activity
- Step 5 Determine the appropriate characteristics of the information system to support managerial actions, describing
 - a. the information characteristics and contents
 - b. the kind of information transformation needed

c. the report characteristics from
manager's point of view [58:42]

2. To analyze organizational information requirements

This particular step has to be carried out immediately after information systems goals and strategies have been identified and documented (9:460). It is to analyze, identify and document all information needs for different levels in an organization. It includes the following steps.

- (1) Define functional processes/activities and sub-systems in the organization.
- (2) Develop a process vs. sub-units/managers matrix.
- (3) Define and evaluate information requirements of each of the functional process (organizational sub-systems) identified earlier.

3. To allocate organizational resources (9:463)

This stage helps to allocate organizational resources to the many information/application systems identified earlier. To do this, the implementation priority of each application system has to be decided first based on the following four types of evaluation factors.

- (1) Quantitative factors such as increase in profit figure
- (2) Qualitative factors such as improvements in morale or working environment which are hard to be quantified

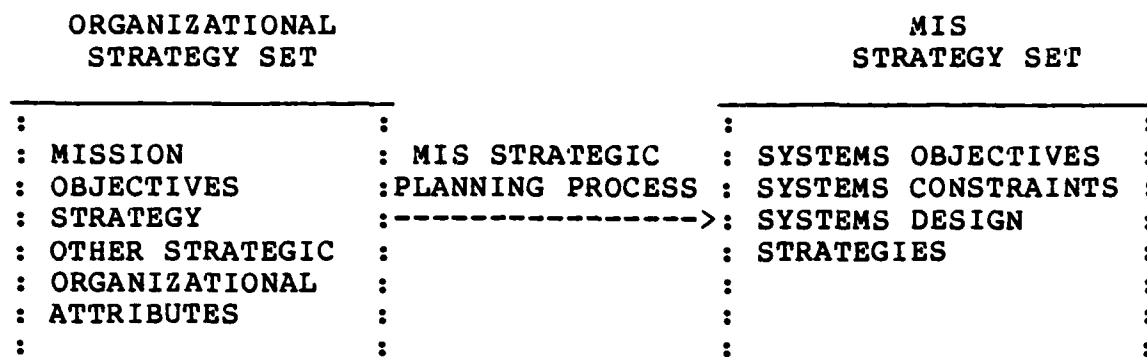
- (3) Institutional factors such as certain applications systems should be given higher priority due to the need to have an orderly development approach within the organization
- (4) System management factors such as certain application systems have to be implemented before the others due to its providing key input to the rest of the applications.

Different Information Systems Planning Approaches.

There are many different information systems planning approaches suggested by different MIS experts. A study of all the selected sources listed in the bibliography section of this report reveals that the following approaches are the most recent and commonly used approaches and methodologies by organizations in their information systems planning exercises or studies.

1. MIS Strategic Planning Process suggested by King
(27:27-37; 30:303-304)

This planning process "ensures that the MIS is developed as an integral part of the organization and not merely appended to it" (27:36). It has been used by IBM as a foundation to develop its Business Systems Planning Methodology (9:484-485; 24). The overall MIS strategic planning process can be better presented pictorially in Figure 5.



**Figure 5. Overall MIS Strategic Planning Process [28:28;
30:304]**

As shown in Figure 6, this planning process does not provide detailed steps for identifying and documenting data and processes required to be automated in order to support organizational objectives and strategies. It merely involves the "identification and assessment of an Organizational Strategy Set -- an informational set which delineates the organization's mission, objectives, strategies and other strategic attributes" (27:36). Through the MIS strategic planning process, the "Organizational Strategy Set" can then be linked and transformed to a "MIS Strategy Set". This "MIS Strategy Set" includes objectives, constraints and design strategies for the particular MIS(s). The results obtained from the MIS strategic planning process can then be used as the basis or starting point for all subsequent systems development activities. This planning process comprises the following steps.

- (1) Identify, explain and analyze the

organizational strategy set by:

- a. examining in detail the structure of the organization;
- b. identifying goals for each functional sub-units within the organization; and,
- c. identifying the organization's purposes and strategies relative to each sub-units.

(2) Link and transform the "Organization Strategy Set" to a set of systems objectives, systems constraints and systems design strategies

As step-(2) above is essentially the key to the entire planning process , King suggested that the method which can be used to developed the "MIS Strategy Set" is one that the

analyst makes inferences based on their experience and knowledge of information systems: the range of system objectives, characteristics and design principles are shown to be consistent with the elements of the organizational strategy set [27:35].

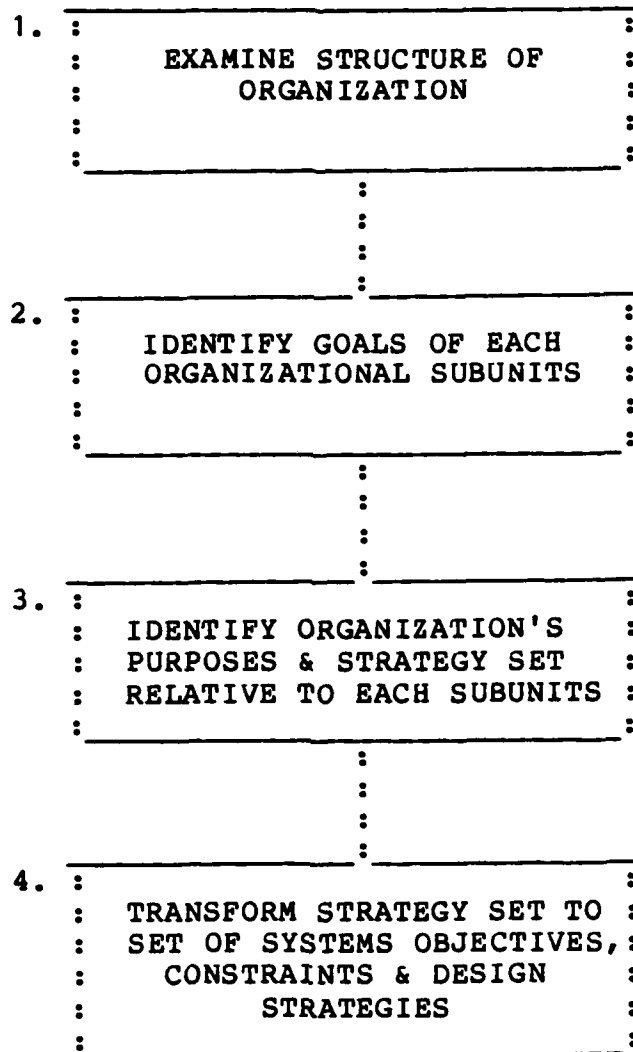


Figure 6. MIS Strategic Planning Process

2. MIS Strategic Planning Framework by Mclean and Soden (37:24-27; 30:304)

This framework, as shown in Figure 7, provides a comprehensive model of information systems planning that emphasizes on those processes before the specification and implementation of an information systems master plan. It involves the following steps summarized below.

- (1) Set the MIS mission reflective of the organization's mission
- (2) Assess organizational environment by looking at the risks and opportunities, state of the art in MIS, and external and internal capability of the organization
- (3) Define MIS objectives
- (4) Develop MIS strategies
- (5) Develop MIS policies
- (6) Carry out Long-range MIS planning
(conceptual)
- (7) Carry out Medium-range MIS planning
(managerial)
- (8) Carry out Short-range MIS planning
(operational)
- (9) Implement plans

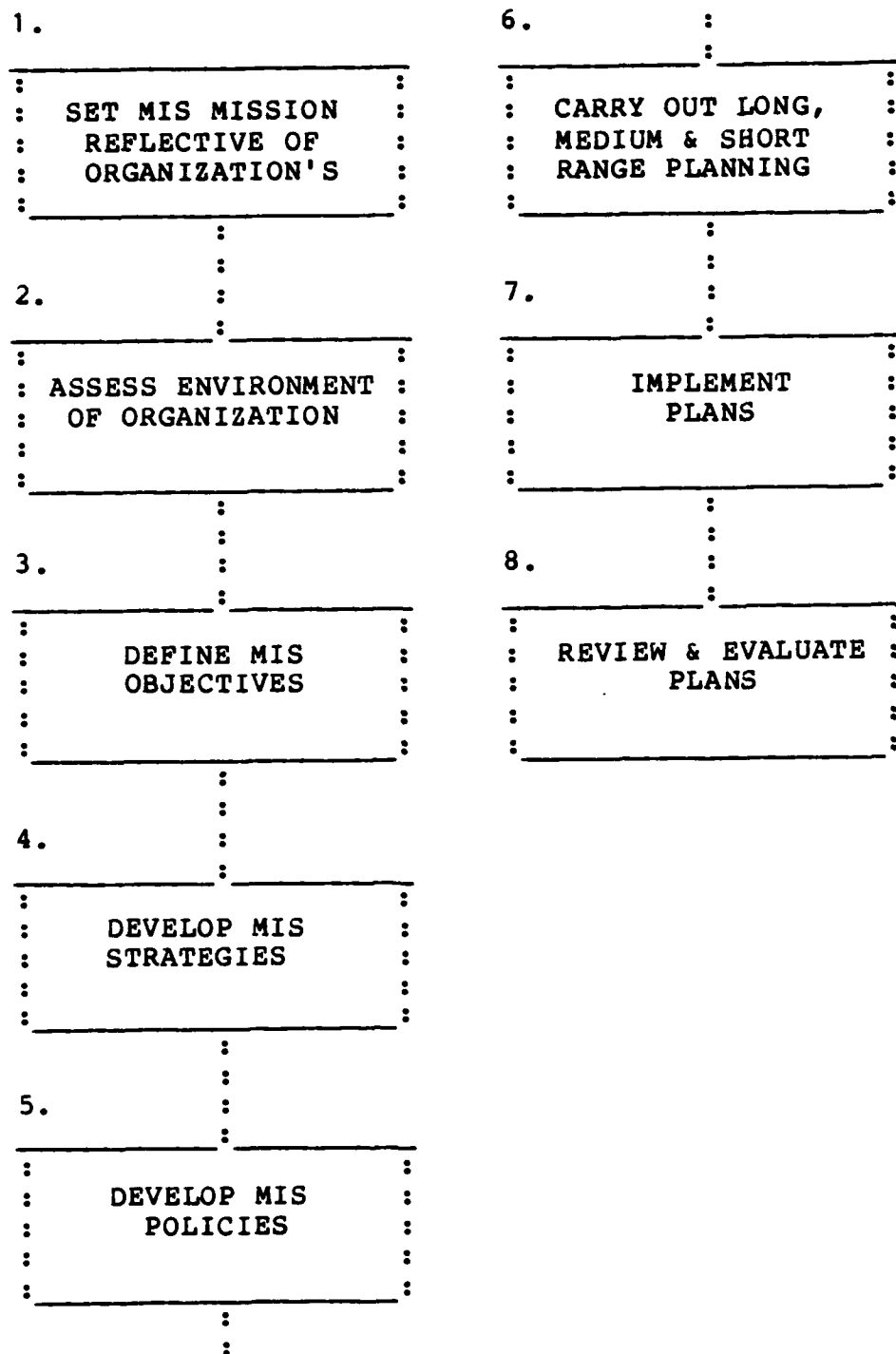


Figure 7. MIS Strategic Planning Framework

3. Critical Success Factor (CSF) Analysis suggested by
Rockart (47; 48; 32; 33; 51; 54:196)

This planning methodology, as shown in Figure 8, is a way to identify corporate information systems plan by focusing on the critical success factors (51:121).

According to Rockart, this planning methodology mainly uses interviews or other channels to request every staff member at all levels of the organization to focus their attention on critical organizational issues which will affect the overall performance of the organization (47:81).

Experience with critical success factors shown that they are very effective and useful in assisting top management and corporate planner to identify and define their critical strategic information needs (54:196). Martin also reported that "CSFs are useful to top management in understanding how to cope with and in evaluating the MIS/DP organization" (32:9). Briefly, it comprises the following steps.

- (1) Development of an overall "helicopter-view" of the organization and its business operations by the analysts or planners
- (2) Interview of staff members from all levels of the organization for their prepared list of critical success factors
- (3) Consolidation of all the lists of critical success factors into one for the

corporation/organization

- (4) Use of the consolidated list of corporate critical success factors in reviewing organization structure and in performing the strategic planning
- (5) Use of these critical success factors to identify information needs and information infra-structure for the organization
- (6) Review and finalization of the organization's critical success factors with the staff members
- (7) Development of individual information needs
(51:125)

Besides being used by top management and the corporate planners, CSFs are equally effective for use at every level of management in an organization and give the following significant benefits (54:198).

- (1) Assists managers to identify and ensure critical factors are given due management attention;
- (2) Enables managers to collect only those information they really need and thus eliminate unnecessary cost associated with collection of redundant information; and
- (3) Helps the organization to focus attention on those data that are important for particular level of management and may not be collected.

Because of the above benefits, the critical success factor analysis methodology is widely used by many government and business organizations. It will be used in conjunction with other informaton systems planning methodologies to ensure the completeness of the planning study results.

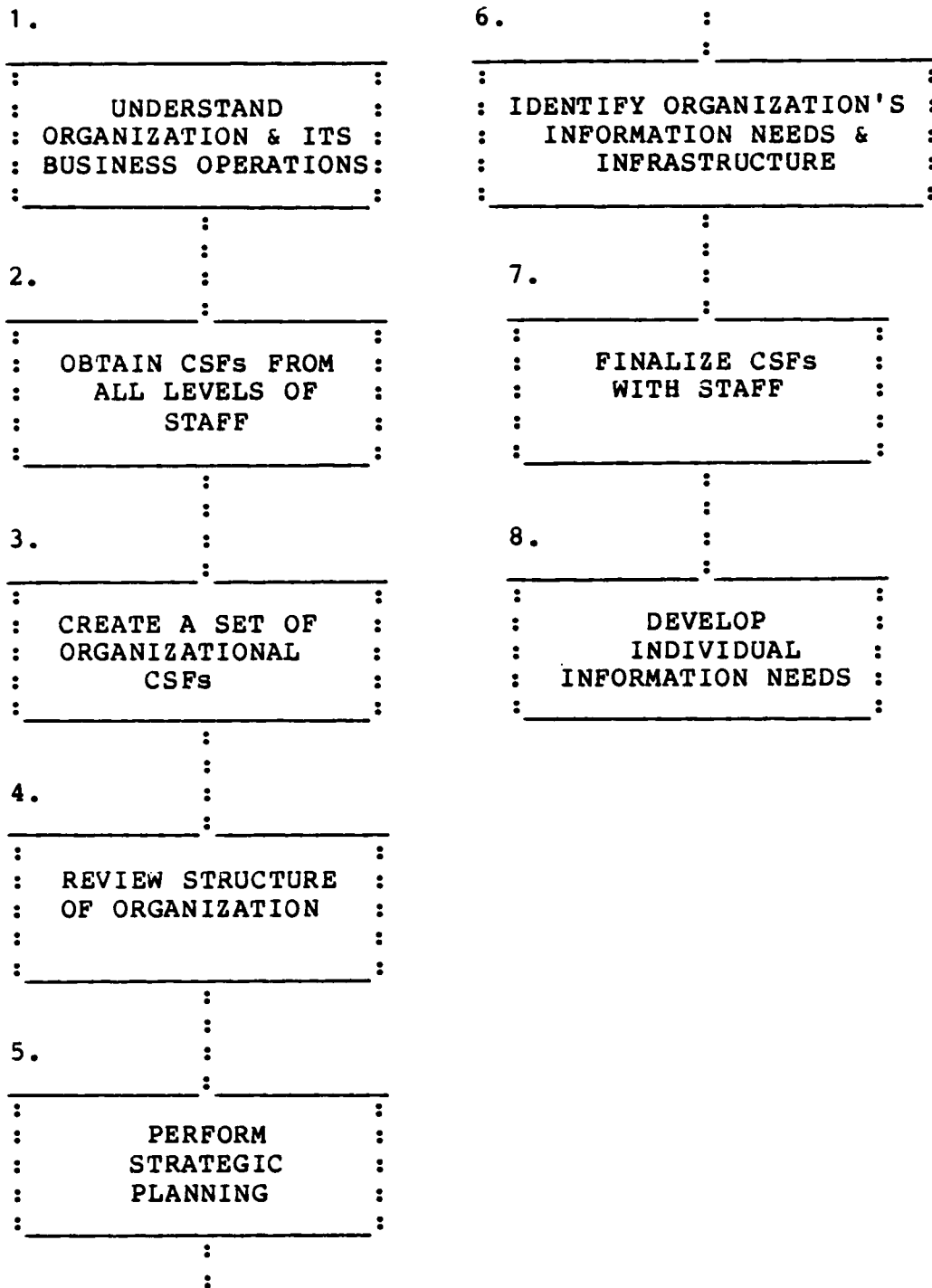


Figure 8. Critical Success Factors Analysis

4. Business Systems Planning methodology developed by International Business Machine (IBM) Corporation in the early 70's (9:484-485; 24)

This planning methodology, as shown in Figure 9, is user and objective driven. It is developed based on the King's MIS Strategic Planning Process discussed earlier in this section. This planning methodology has the following characteristics.

- (1) A top-down planning approach in getting people committed and involved and in examining the business and its environment
- (2) A bottom-up approach to implementation
- (3) Treating data as a corporate resource
- (4) Use of a structured methodology proven in hundreds of studies
- (5) The translation of business objectives into information requirements
- (6) Orientation around business process (24:1-2,11)

According to Rockart, this planning methodology is "the most widely used formal procedure to accomplish the total study" (47:84). This planning methodology provides the following planning sequences for the information systems planners to follow.

- (1) Gain commitment from all levels of management
- (2) Prepare for the business systems planning study
- (3) Kick-off the study

- (4) Define corporate mission/goals/objectives and strategies in order to ensure agreement among all levels of organization and that the information systems strategies developed can directly support corporate mission
- (5) Define business processes that required information support
- (6) Define the necessary data classes based on the business processes to be supported by the information systems
- (7) Analyze current systems support by showing how data processing currently supports the organizational business
- (8) Define the information architecture in the form of a statement of the long-term information systems objectives. Concurrently, determine the implementation priority of each architecture and review the information resource management issues and problems.
- (9) Develop business systems plan that includes recommendations and action plans for each of the information architecture or individual module (information system)
- (10) Report results to top management for considerations and approval (24:13; 9:484; 47:84)

The objectives of this methodology include the following.

- (1) Provide overall perspective and understanding of organization's business and functions
- (2) Identify information necessary to manage the business
- (3) Examine the existing information systems

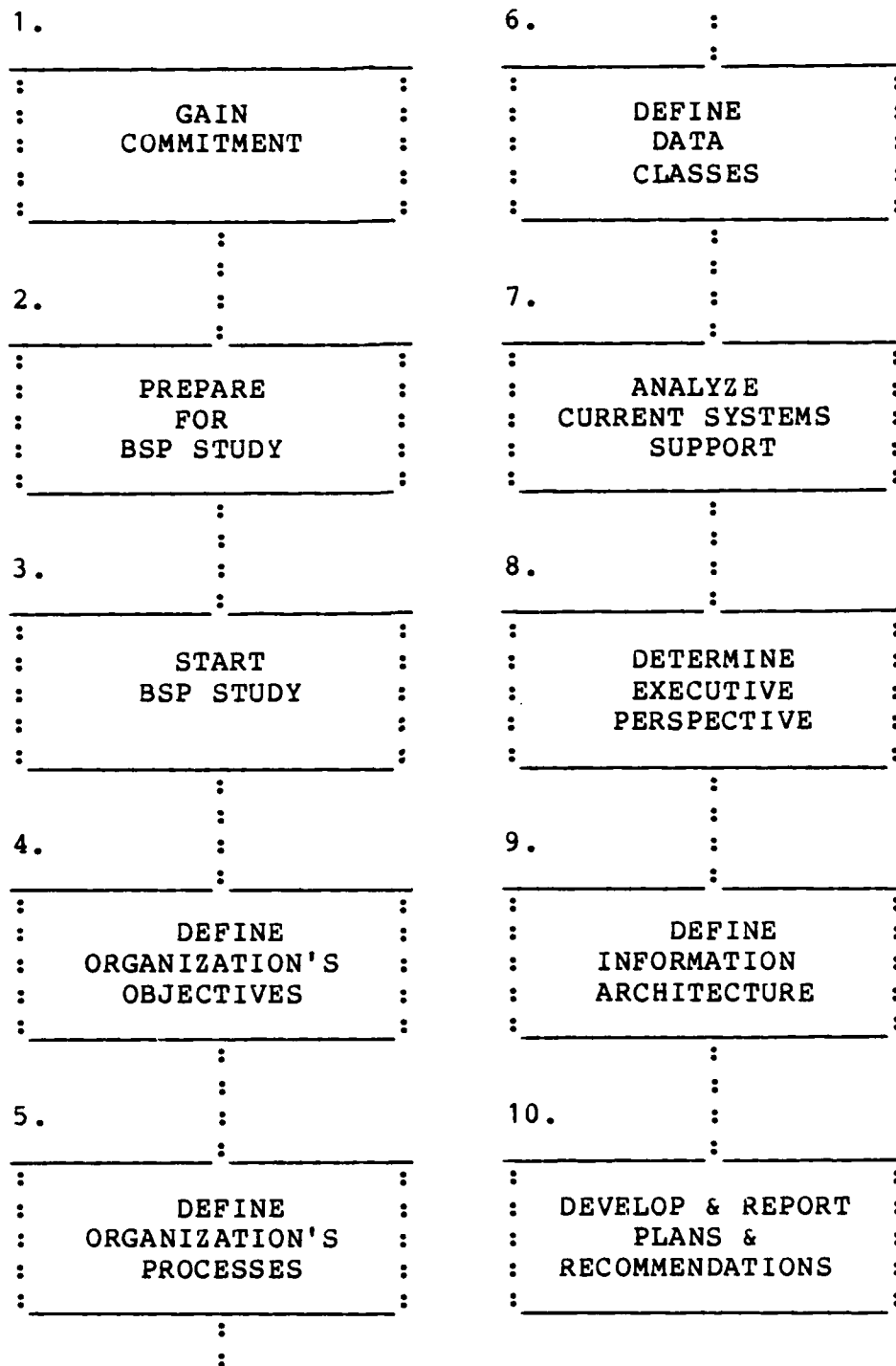


Figure 9. Business Systems Planning Methodology

5. Long-range Planning Model reported by Thierauf
(54:189-190)

According to Thierauf, long-range planning should begin with a good and comprehensive understanding of existing products, organization setting, organizational resources such as financial assets and personnel skills etc. (54:189). The entire planning process should commence by establishing organizational objectives and the plan developed eventually should be constantly updated so that it will have minimum difference with organization's operating environment and its standing/situation.

This planning model, as shown in Figure 10, is similar to the Business Systems Planning Methodology (9:484-485; 24) mentioned earlier and the Information Systems Planning Methodology (53) used by the Republic of Singapore Air Force (to be discussed later) in terms of its starting point for the entire planning process. However, it does not offer detailed steps or tools for information systems planner to use in identifying and documenting detailed information and data required by each functional area. This planning model includes the following steps outlined below.

- (1) Establish objectives for the organization
- (2) Develop overall corporate strategies that are compatible with the organizational objectives
- (3) Identify external environmental factors that affect operations within the organization

- (4) Specify long-range plans for different functional sub-units
- (5) Develop long-range plans for each of these functional sub-units
- (6) Review the long-range plan periodically to reconcile any differences between the plan and the existing environment that the organization is operating
- (7) Analyze any differences and determine their impact on the long-range plans already developed
- (8) Update the long-range plans by incorporating necessary changes which are required to minimize deviation of the plan from the actual situation

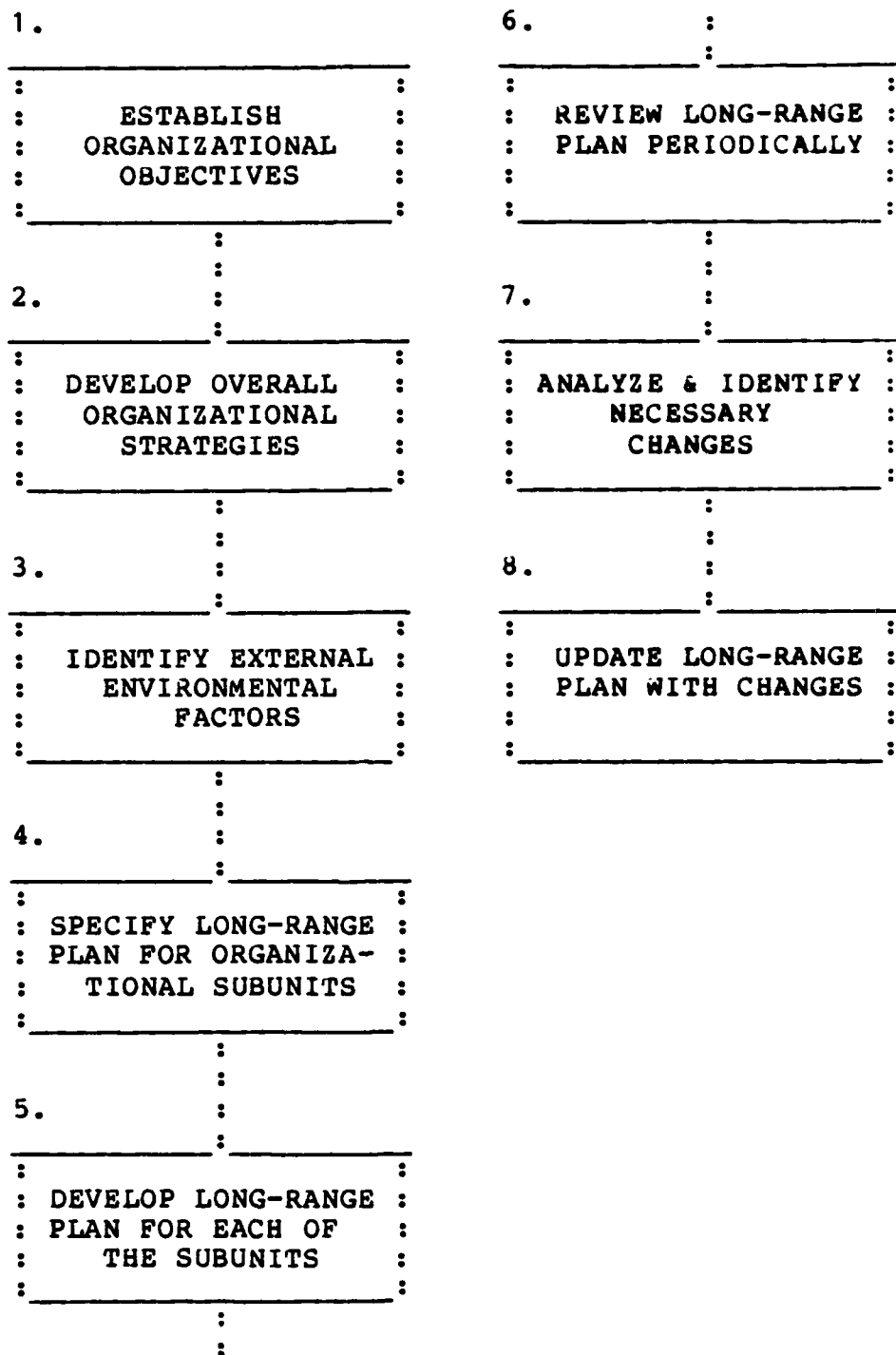


Figure 10. Long-Range Planning Model

6. Corporate Data Plan methodology recommended by Cohn
(6)

Cohn suggests that "information analyst should address project development to reflect the goals and objectives of the business plan and the business environment" (6:31). This methodology, as shown in Figure 11, uses top-down planning approach as the Business Systems Planning methodology for examining the organization itself, its organizational (business) environment and the functions performed by the organization(s) in order to meet the business goals and objectives (6:33). The detailed steps of this planning methodology are as outlined below.

- (1) Study the sub-business units/components of the organization
- (2) Identify business functions (cost centers) within the organization
- (3) Identify business processes required to be performed in order to meet the business goals and objectives
- (4) Identify business activities that are required to accomplish the business processes
- (5) Derive the business entities (data) that are used in the business activities
- (6) Obtain the subject data bases which comprise related data components and reflect the business operating environment (6:32)

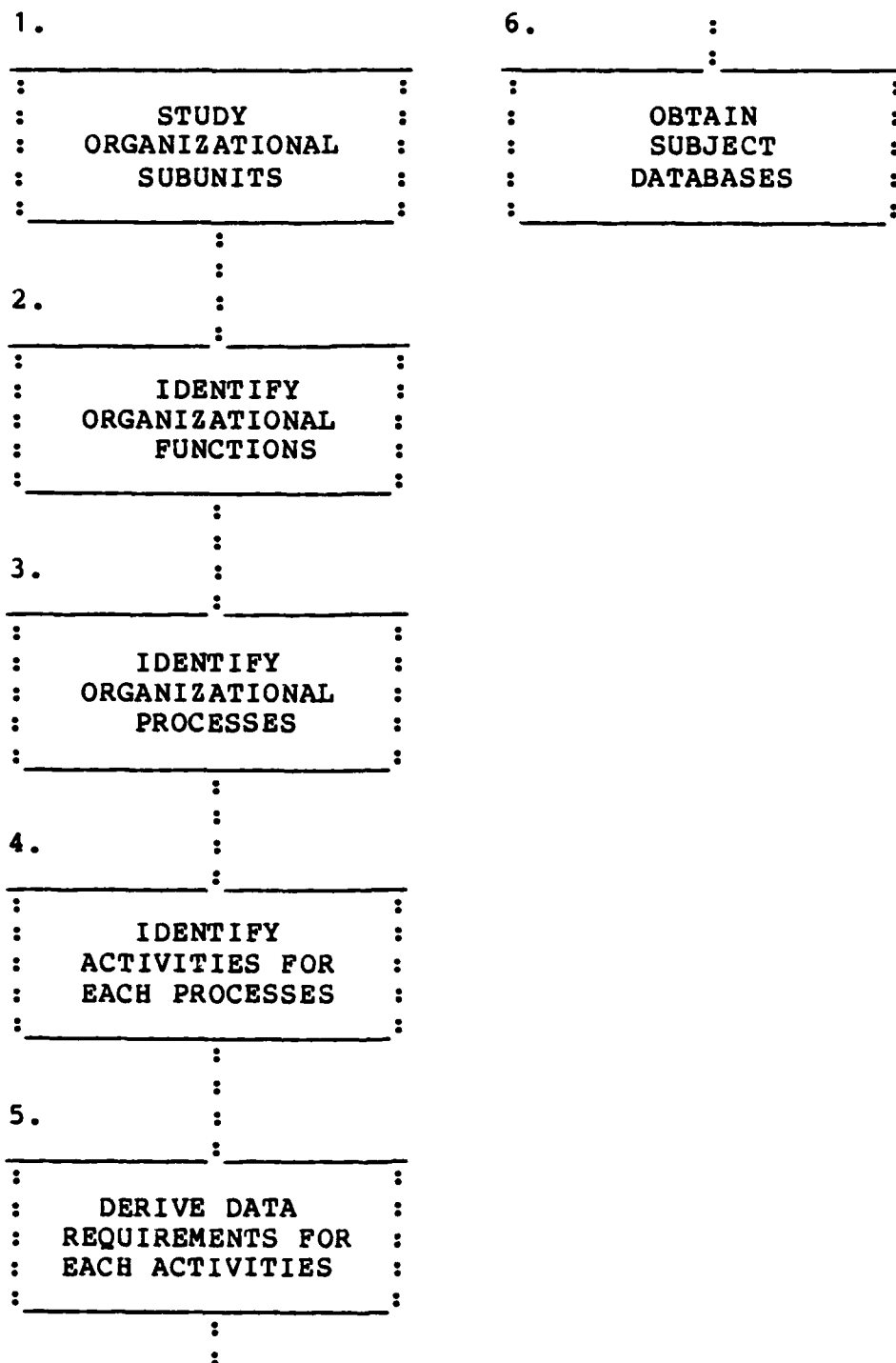


Figure 11. Corporate Data Plan Methodology

7. Information Systems Planning Methodology packaged by Systems & Computer Organization, Ministry of Defense, Singapore (53)

The methodology packaged for use in the Republic of Singapore Air Force information systems planning study is an eight-step method with top-down information identification and bottom-up systems planning approaches. It is a user, objectives, and data-driven methodology that ties the information systems planning and the identified data closely to support the strategic objectives of an organization. As shown in Figure 12, it is packaged by integrating the IBM's Business Systems Planning Methodology (9:484-485; 24) with the Information Engineering's Information Analysis and some other structured tools such as the Data Flow Diagram and entity list (9:487,580; 10). It is very effective in identifying information needs of an organization and in developing an integrated information systems plan. The summarized steps/tasks of information systems planning are outlined below.

- (1) Define organizational mission statement (highest level)
- (2) Examine business environment by studying the strategic objectives, products and services performed as well as the markets and channels of the organization concerned
- (3) Derive corporate objectives statements

supporting the corporate mission statement
identified earlier

- (4) Derive the lists of business processes performed by the organization using the Data Flow Diagram of Structured Analysis methodology suggested by DeMarco (9:487,580; 10) and other graphical tools such as data modeling, processes vs. sub-units matrix etc. (9:507; 24; 53)
- (5) Derive the lower-level sub-units in the organization
- (6) Identify and document information needs of each of these sub-units using the relational data model and entity list techniques
- (7) Integrate all these data requirements into a organizational data model to reflect corporate information requirements
- (8) Develop information systems master plan upon completion of the following activities identified below.
 - a. Packaging the business processes into information systems and identify data model for each of these information systems
 - b. Prioritizing information systems to produce information systems implementation plan based on the following four criteria

- i. Urgency of need of information systems
- ii. Impact of the information systems to
the organization as a whole
- iii. Probability of implementation success
- iv. Degree of dependency on advanced and
future information system technology
- c. Estimating computer hardware and software
requirements from the transaction volumes
gathered from existing manual systems with
some allowance built in for future
expansion.
- d. Establishing information resources
management policies, the necessary infra-
structure and organizational set-ups for
future computer operations and support
- e. Estimating budgets, manpower requirements
and other resources required to implement
the entire information systems master plan
for management approval

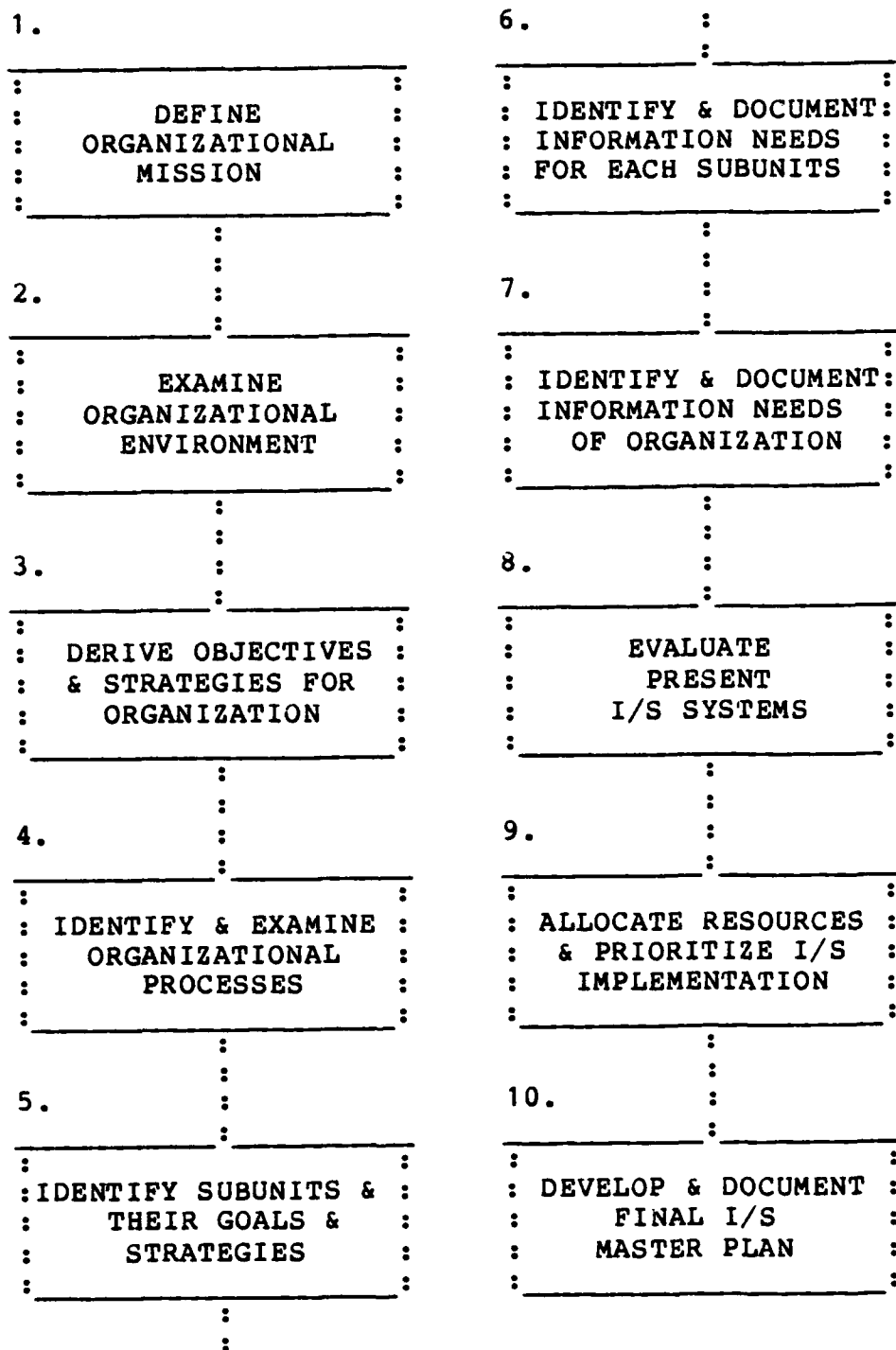


Figure 12. Information Systems Planning Methodology

Some of these planning methodologies emphasize a particular aspect, such as setting objectives not only for the corporate level but also for the information systems planning activity itself and all the subsequent information systems development projects as well (12; 42:251-253), or using the critical success factor analysis method to ensure that all key issues and information are being considered in the information systems planning study (47; 48; 32; 33; 51; 54). All the seven information systems planning methodologies examined provided different numbers of planning steps for the systems planners to follow. Some of which are of higher level such as the MIS strategic planning process suggested by King (27:27; 30:303-304) and others did not cover the entire three stages of information systems planning as proposed by the three stage model of information systems planning of Bowman and others (2:15-21; 9:455-456). Results of a survey of 20 MIS professionals from diversified industry sectors done by Soden and Tucker showed that more than 90% of these MIS professionals used a combination of top-down and bottom-up planning approach (52:32). In addition, studies done by the Ministry of Defense, Singapore in 1984 also reflected that planning done by organizations usually differed in terms of frequency, focus, level of emphasis and the period covered by the planning (53). The processes suggested in the different information systems planning concepts and methodologies differ from one another

slightly depending on their different emphasis. There are differences in terms of the degree of details or depth of the planning methodologies, the degree of flexibility and whether they provide detailed tools for planners to use to collect, identify and document data and information. Among the seven planning methodologies listed above, only the Business Systems Planning Methodology (9:484-485; 24) and the Information Systems Planning Methodology (53) provide some more detailed tools such as units vs. process matrix, information architecture chart and data-modeling technique etc. for use by the systems planners in some of the planning steps. The Business Systems Planning methodology is a good methodology that advocates a top-down approach and is user and objectives-driven. But it does not provide the necessary techniques to identify the detailed data and format required for later systems analysis and data base design phases as provided by the information systems planning methodology.

Important Considerations for Implementing Information Systems Planning. The most important consideration in information systems planning implementation is to have precise and measurable objectives defined before starting other information systems planning activities (12:26; 14:34; 21:29). This is necessary because the clear and measurable objectives can then be understood easily by all the people involved in the planning processes, and hence can speed up

the subsequent identification of lower level organizations' objectives and information needs (12). In addition, the clear, achievable and measurable objective give directions to planner and hence motivate them to move ahead to plan for the information systems requirements. Some of the guidelines for setting objective(s) for the organization or for the information systems planning studies are as follows.

1. It should start with the word "to" followed by an action or accomplishment verb.
2. It should be as specific and quantitative (and hence measurable and verifiable) as possible.
3. It should specify only the "what" and "when" and exclude the "who", "why" and the "how".
4. It has to be consistent with the resources available or anticipated for the organization concerned.
5. It must be realistic and attainable, but still provide significant challenge and motivation.
6. It has to relate directly to relevant higher-level missions, objectives, goals and strategies.

Other important implementation considerations include the following areas.

1. Proper selection of information systems planning team members
2. Active user participation/involvement
3. Strong top management commitment (25:37) and

active senior management participation (46:10).

Rhyne felt that it is important for senior management to participate actively in the entire planning process in order to have a successful implementation of the true strategic planning for the organization

4. Proper training of information systems professionals in inter-personal relationships and communication skills (22:36; 14:34,37; 40:9)
5. Planning team experience
6. Project complexity, project duration and planning requirements (55:12-15)
7. Let management determine information usefulness (40:9)

As realized from the Republic of Singapore Air Force information systems planning study, the top management commitment and support can be obtained relatively easier by giving regular presentations and briefings on findings of information systems planning at the relevant planning stages (or steps). The difficulty lies in maintaining the consistent and equal participation and interest of both the user management and the data processing staff involved in the information systems planning study.

Possible Benefits Derived from Information Systems Planning Study. Information systems planning as evidenced

by the Republic of Singapore Air Force information systems planning study have included the following advantages.

1. Enables users and information systems professionals to identify their perceived problems earlier, and hence reduce the risk of information systems implementation failure (24).
2. Creates better users-information systems professionals interactions and communication channels, thus indirectly encourages more active participation by users and management in the subsequent phases of the information systems development project (55).
3. Enables easier control of schedule, cost and performance of all the information systems development projects (13; 54). This is so because an information systems plan properly worked out and documented in detail, detailed plan for lower level information systems development activities can also be worked out easily. These lower-level plans can be used by information systems professionals and implementation co-ordinator to control the many different information systems development and maintenance tasks so that the information systems plan can be realized as close as possible.
4. Helps both user management and MIS managers to make speedy and accurate decisions if problems are

encountered in the information systems development phases (49; 53).

5. Reduces probability of information systems implementation failures which include
 - (1) Cannot meet the users' needs
 - (2) Cannot integrate or communicate with existing information systems used by the same users
 - (3) Exceed the budgetted costs and development time-frame (15:1637)

This is so because the information systems planning activities give both the planners and the implementers a better feel of the nature, complexity, magnitude and probability of failure of the various information systems development tasks (54). They can hence identify the most critical tasks and tasks with high-failure possibility and devote more resources and efforts on them. By so doing, they can indirectly reduce the chance of information systems implementation failures as a whole.

Problems Faced in Information Systems Planning Studies.

The single most serious and difficult problem faced by information systems planners is the translation or transformation of organization's objectives into comparative and supportive strategies, information systems planning objectives and strategies (4:119). This is so because in some organizations, organizational planning is not well developed and practice is not as frequent as it should be

especially in non-profit oriented public organizations. Head reported that "systems planners in government agencies often have difficulty trying to relate systems plans to the goals and objectives of their agency" (20:8). This is true because often, there is no clear-cut organizational long-range objectives and planning assumptions for information systems planners to follow. There may be cases where organizations do not even have any formal statement of organization objectives and the reasons for their existence. Even if there is, most often, the objectives have not been made known to all level of management and staff in the organization. Or the objectives have not been constantly updated and hence are overtaken by events. The other important and frequently cited problems faced in the information systems planning include the following.

1. Lack of top management commitment and support
(11:6; 19:16; 27:75; 45:72; 50:27)

In most instances, top management do know the importance of information systems planning to their overall organizational operations and performance. However, they often do not give enough tangible or visible support to the entire information systems planning effort. Often, they merely give lip-service if not totally delegate the supervision and control of information systems planning studies to lower level management. Executive steering committees which set policies for data processing operations

and monitoring the information systems planning processes can help to overcome this problem to certain extent (11:6; 45:72).

2. Organizations failed to constantly manage, update and audit their planning systems

According to Kelly, "very little has been written about how ongoing planning systems can be examined and adjusted" (26:14). He suggested that the use of a "Planning Process Audit" can provide management with a tool which help them to easily separate the desired end results of planning from the planning process itself and highlight problems that required management attention (26:14). Vanecek felt that information systems planning should be a continual process else the entire planning exercise will not be able to response to the rapid changes in technology, organizational needs and organization's environment etc. (56:10).

3. Lack of users involvement/support/interests

User involvement has been articulated by many MIS experts to be an important element of systems planning, development and implementation (44:27; 19:14). Adequate level of user involvement (somewhere between high involvement and no-involvement) according to Nicolas can help to reduce users' resistance to change, improve the usefulness of the systems developed and hence lead to better enhancement of the systems by the users (44:24). In addition, Head (21:29) recommended the following two points

which are important for obtaining better and effective user involvement in all kind of MIS projects with different size and nature.

- a. User-friendly application software or packages that cater to the needs and interests of end users
 - b. A managerial climate that encourages and supports end user computing
4. MIS designers do not have necessary experience, knowledge, skills and methodologies to help users in their planning of information systems and data requirements

As information systems planning is considered one of the systems development activities, many problems faced in the systems development process or by the MIS departments/managers are equally applicable to it. Without proper and adequate planning experience, knowledge, skills and methodologies, an information systems specialist is handicapped in his ability to help users to perform a complete planning to identify all their required data, information and processes that needed to be automated.

5. Management's skepticism about the usefulness of information systems planning in helping the organization to attain organization's objectives

Managers who do not believe in the usefulness of information systems planning process and resist planning

usually because "they believe it is costly and ineffective" (39:99). These managers often link the planning activities with bureaucracy and their previous unpleasant planning experience. Many of their condemnation originated from the lack of clear and correct planning directions from the top management and too many bureaucratic controls and procedures.

6. Conditions to motivate planners to consider areas that beyond their present scope of duties or organizational boundary are not present

Planners involved (both users and information systems specialists) are faced with constraints which do not motivate them to look beyond the scope of their own organizational and personal responsibilities (29:56). One of these constraints might be to simplify problems to its salient features and assuming that it is a right problem. Often, this is not the case and the planners may end up with solving the wrong problem if they adhered to these non-tested and unsound organizational constraints.

Pitfalls of the Existing Information Systems Planning Methodology Used in the Republic of Singapore Air Force.

Fortunately, there are not many pitfalls of information systems planning except for the two listed as follows:

1. The existing information systems planning methodology used in the Republic of Singapore Air Force does not provide parameters or criteria for

planners to measure completeness and accuracy of the information systems plan developed.

2. Plans developed using the existing information systems planning methodology are not flexible enough for subsequent updatings due to volume of data and ways of documenting these data.

Future Developments of Information Systems Planning.

To resolve the pitfalls of information systems planning, further research in this area is necessary in order to keep up with the rapid advancement in computer hardware and other related peripherals. Some computer-aided semi-automated planning methodologies may be available in the near future (36; 53). Using the computer as the storage base for the voluminous data collected throughout the information systems planning study, planners can then be relieved of the time-consuming and tedious task of maintaining such data up-to-date for the next planning meeting or management briefing. In fact, there are already in operation some information systems implemented successfully using the computer aided planning approach as reported by Doyle and Becker (14:33-45). This is a positive sign which indicates that some measurable and automated information systems planning methodologies will be made available to corporate and MIS planners very soon.

Summary

The urgent need for effective, measurable and automated information systems planning methodologies and concepts is obvious, as can be seen from the findings of this review (5:8; 22:36; 53). Most of the information systems planning methodologies available today are easy to apply. The success of an information systems planning study lies with the skills and experience in selecting the right information systems planning methodology and making the correct planning assumptions based on the three stage model of information systems planning framework developed by Bowman, Davis and Wetherbe. With the right choice of information systems planning methodology followed by careful selection of the planning team and proper monitoring, an integrated and comprehensive information systems plan can be developed.

As the organization and its business environment become more complex in nature, the planning for information systems will require more and more effort and resources in order to ensure that all the important and related information is packaged into an integrated information system (6:32; 24; 53). An information systems planning study may become a complex project that requires several months of full-time involvement by both the top user management and MIS managers. It is worth all these efforts because the study results are very rewarding, as evidenced by the results of such a study conducted in the Republic of Singapore Air Force from September 1984 till April 1985 (53).

This review documents in detail the following nine areas of information systems planning.

1. Importance of information systems planning
2. Relationships between information systems planning and organization's strategic planning
3. Three stage model of information systems planning developed by Bowman, Davis and Wetherbe (2:11-25; 9:455-456)
4. Different information systems planning methodologies
5. Important considerations for implementing information systems planning studies
6. Possible benefits that can be derived from the conduct of an information systems planning study
7. Problems faced in information systems planning studies
8. Pitfalls of the existing information systems planning methodology used in the Republic of Singapore Air Force
9. Future developments of information systems planning

Further research in information systems planning methodology is necessary in order to keep up with the rapid advancement in computer hardware and other related peripherals. In the near future, one can expect to see some computer aided information systems planning methodologies that are measurable and flexible for updating changes. Some

of the potential research areas in information systems planning methodology include the following listed below.

1. Incorporation of some measurable criteria for assessing the quality of the information systems plan developed
2. Automation of tools such as the data dictionary and data flow diagram etc. (9:505; 10; 53) used in information systems planning study in order to speed up the tedious updating process
3. Incorporation of tools such as work breakdown structure (WBS) to make the identification of business processes and lower level organizations easier

In summary, there is no one "perfect" information systems planning methodology applicable to all kinds of organizations. An organization will have to decide which is the most suitable one applicable to its needs and apply it with all the important considerations of information systems planning in mind (12:30). In addition, a good information systems plan, once developed, must be constantly updated so as to be current, relevant and accurate. Without a proper control over the progress of information systems development and a good feedback mechanism, information systems planning, even if carried out using all the best methodologies available, will merely remain good on paper and will be a waste of time.

III. Research Methodology

Overview

The research methodology for this thesis is a combination of literature search and model development. The literature search focuses on the many information systems planning articles and research reports published by various MIS experts in periodicals such as the Journal of Systems Management, Harvard Business Review, Management Science, MIS Quarterly, and Journal of Management Information Systems. A generic information systems planning model that would generally be applicable to different kinds of organizations (with some modifications or different extent of usage) is developed from a synthesis of the literature reviewed.

Specific Steps

The research methodology used in this thesis research comprises the following steps outlined below.

1. Collect various literatures on information systems planning and then conduct an in-depth analysis of their contents especially in the area of information systems planning methodologies and related practical issues.
2. Develop a set of selection criteria for selecting the planning steps to be included in the generic information systems planning model.

3. Critically analyze the planning steps mentioned in several major information systems planning methodologies reviewed against the set of selection criteria. From this analysis, select those planning steps for inclusion in the generic information systems planning model.
4. Construct a generic information systems planning model that is generally applicable to different kinds of organizations by consolidating and combining the various planning steps identified in step three. Additional planning steps which are not mentioned in any of the seven information systems planning methodologies reviewed are included based on the general opinions of MIS authors' views, the subjective judgment and personal experience of the writer.
5. Describe in detail each of the planning steps in the generic information systems planning model. Also to identify and specify tools systems planners may find appropriate to use in the various planning steps.
6. Discuss the implementation details and considerations of this generic information systems planning model, a critical aspects to consider for successful information systems planning. Also, to highlight the possible strengths and weaknesses of

the generic information systems planning model by comparing it with other information systems planning methodologies reviewed and to compile a list of guidelines applicable to this generic information systems planning model.

7. Examine the applicability of this generic information systems planning model by looking at how this model can be used in several organizations having different characteristics and information processing requirements. Specific organizational scenarios are created for detailed explanation on the usage of this model.
8. Recommend possible future research areas to further enhance the generic information systems planning model.

Unique Feature

This thesis attempts to synthesize various approaches for performing an information systems planning analysis within complex organizations. Thus, the majority of the research time was spent on the continuing search and review of current new planning methodologies used by different organizations and on developing the generic information systems planning model.

The significant aspect of the research methodology is to ensure that the set of criteria developed for selecting

the planning steps for inclusion in the generic information systems planning model are as objective, sufficient and complete as possible.

Criteria for Selecting Certain Planning Steps for Inclusion in the Generic Information Systems Planning Model

In order to develop a generic information systems planning model, certain selection criteria will first have to be determined in order to choose the planning steps from the information systems planning methodologies reviewed and incorporate them into the generic information systems planning model. Since a comprehensive literature search on such selection criteria failed to secure any criteria which are adequate for this purpose, the following criteria were identified which appear intuitively sound and logical.

Reasons for Having These Selection Criteria. The selection criteria are chosen based on the common sense, personal opinions of the reporter and the frequency of information systems planning steps being cited by MIS experts. It is necessary to have selection criteria in order to:

1. Ensure that planning steps selected into the generic information systems planning model are with sufficient reasons and justifications obtained so that the end product (i.e. the generic information systems planning model) can be more acceptable than others;

2. Maintain consistency with other planning steps in the model by ensuring that the selection process for choosing the planning steps to be included into the generic information systems planning model is as complete and fair to the extent of being consistent with the knowledge and findings of the various MIS experts;

3. Ensure higher logical flow of planning steps within the model by combining those planning steps that are closely related to a single planning task and discarding those that are either duplicative, irrelevant or redundant. (In other words, this is to perform a synthesis by combining, rearranging the many planning steps suggested in the information systems planning methodologies used currently); and

4. Capture all necessary planning steps advocated by different MIS experts into the generic information systems planning model in order to ensure that the model developed using these criteria would be as complete and objective as possible and could be used by different organizations under different circumstances with only minimum adjustments or minimum elimination of some of the planning steps (not with major modifications or changes to the generic information systems planning model).

Selection Criteria. The following are the four main criteria that were used to select the planning steps to be included in the generic information systems planning model.

1. The commonality among the seven different information systems planning methodologies

The rationale being that the most commonly cited planning steps among the planning methodologies advocated by different MIS experts should be the steps that are of greater importance and necessity for developing a successful and meaningful information systems master plan and hence warrant our selection.

2. The frequency that the particular planning activities were mentioned in the MIS literatures but were not specifically identified as information systems planning steps

For instance, certain planning activities mentioned and emphasized by the MIS experts in their articles (e.g., setting objectives for information systems planning as well as for the information systems to be developed was suggested by Doll and others (12:28)) were not included in any of the seven planning methodologies examined. This criterion is necessary to ensure that we do not omit any important activities or considerations which are not included as steps in the seven planning methodologies being examined. By taking this criterion in mind can help us to obtain a more complete planning model.

3. The degree of relevance and inter-relationships of a particular planning steps being selected with the other selected steps in the generic information

systems planning model

This selection criterion serve its purpose in performing a double-check function on those selected steps. It can help us to eliminate irrelevant and duplicate steps (even though frequently mentioned by MIS literatures) and combine those closely related steps into one so that the final generic information systems planning model is not too complex with too many unnecessary steps. Furthermore, this criterion can be used to evaluate and select into the generic information systems planning model those steps that do not satisfy Criteria one and two stated above but could have high degree of relevance and ability to interconnect those planning steps that have been selected.

4. Contents and criticality of the planning step itself

Once a planning step has been selected either using Criterion one or two stated above, this Criterion four can be used to re-examine and confirm whether the particular planning steps selected are indeed necessary and required to be included in the generic information systems planning model. In cases where a planning step is not being selected as it does not satisfy Criterion one or two, we can use this criterion to confirm whether the step should or should not be selected. If the particular planning step satisfy this criterion well, then it would be included in the generic information systems planning model as a step.

Criterion three and four enabled us to look into the contents of the planning steps, its implications to other subsequent planning steps and/or the entire information systems planning framework in greater detail. For instance, the step which identifies the information requirements for each of the sub-units in an organization even though is not mentioned very frequently in MIS literatures or in many of the information systems planning methodologies examined, it is a crucial step for an organization in order to identify its overall organizational information requirements. This is because it is not possible to know the information requirements of an organization unless the information systems planners perform a bottom-up identification of information requirements for individual sub-units and consolidate, package them into a single, integrated total information needs for the organization.

In summary, Criterion one and two are used as the first-cut selection criteria to choose relevant planning steps into the generic information systems planning model based on the literature review. However, applying these two criteria alone may not produce a complete and logical sequence of planning steps which are important to the entire information systems planning process and thus would be included in the generic information systems planning model. Hence the introduction of Criterion three and four are needed to supplement Criterion one and two. Criterion three

and four besides being used to select planning steps into the generic information systems planning model, could also be used to counter-check the contents, sequence and interconnections among the selected planning steps.

IV. Generic Information Systems Planning Model Development

Introduction

This chapter consolidates all the findings of the literature review exercise and the writer's opinions of the materials reviewed. A generic information systems planning model is thereafter developed by selecting certain planning steps from the following seven information systems planning methodologies (as discussed in chapter II, the literature review of this report) based on the selection criteria discussed earlier in chapter III.

1. MIS Strategic Planning Process suggested by King (27:27; 30:300-301)
2. MIS Strategic Planning Framework by Mclean and Soden (30:301; 37:21-27)
3. Critical Success Factor (CSF) Analysis suggested by Rockart (32; 33; 47; 48; 51; 54:196)
4. Business Systems Planning Methodology developed by the International Business Machine (IBM) Corporation in the early 70's (9:484-485; 24)
5. Long-range Planning Model reported by Thierauf (54:189-190)
6. Corporate Data Plan Methodology recommended by Cohn (6:33)
7. Information Systems Planning Methodology packaged by the Systems & Computer Organization, Ministry of

Defense, Singapore (53)

The main topics to be discussed in this chapter are as follows.

1. The generic information systems planning model
2. The detailed description of planning steps in the generic information systems planning model
3. The implementation details and considerations of the generic information systems planning model
4. The possible applications of the generic information systems planning model
5. The potential advantages and disadvantages of the generic information systems planning model

The Generic Information Systems Planning Model

All the seven planning methodologies examined in chapter II of this report each emphasizes a particular aspect, such as setting objectives not only for the corporate level but also for the information systems planning activity itself and all the subsequent information systems development projects as well (12; 42:251-253), or using the critical success factor analysis method to ensure that all the key issues and information are being considered in the information systems planning study (32; 33; 47; 48; 51; 54:196). These information systems planning methodologies differ from one another in the following areas.

1. Degree of details, scope and depth covered by each of the planning methodologies (eg. different number of planning steps)
2. Degree of flexibility and completeness
3. Availability of detailed tools which can be used by information systems planners to collect, identify and document data and information

Among the seven planning methodologies listed above, only the Business Systems Planning Methodology suggested by IBM (9:484-485; 24) and the Information Systems Planning Methodology developed by the Systems & Computer Organization, Ministry of Defense, Republic of Singapore (53) provide detailed tools for information systems planners to use in some of the planning steps to gather and document their findings. The Business Systems Planning Methodology (9:484-485; 24) is a good methodology in that it advocates a top-down approach and is both user and objectives-driven. Unfortunately, it does not provide the necessary techniques to identify the detailed data and format required for the subsequent phases of systems analysis and data base design phases of a typical information systems development life cycle.

There are slight differences among the planning steps of these seven information systems planning methodologies, depending on their emphasis. For example, the Business Systems Planning Methodology developed by International

Business Machine Corporation (9:484-485; 24) requires a statement of clear and measurable corporate objectives to be defined before commencement of the other planning activities. While the Corporate Data Plan Methodology (6:33) shares the same approach as the above-mentioned Business Systems Planning Methodology (9:484-485; 24), its emphasis however is on the process of developing a corporate data plan before designing the corporate data bases (6). The Critical Success Factor Analysis Methodology suggested by Rockart (32; 33; 47; 48; 51; 54:196) requires a proper study and understanding of the organization and its operations to be made before the planners can approach all levels of individual staff within the organization to obtain their critical success factors.

The generic information systems planning model developed here essentially comprises all the three stages ie. strategic planning, organizational information requirements analysis and the organizational resources allocation as suggested by Bowman and others (2:11-25; 9:455). In addition, this model includes the pre-information-systems-planning activities and the post-information-systems-planning activities so that it can be as complete and comprehensive as possible for the information systems planner to use in any kind of organization. This model is developed using the four criteria as discussed earlier in chapter to select the relevant planning steps from the seven information systems planning methodologies.

Detailed Description of Each Planning Step in the Generic Information Systems Planning Model

The proposed model consists of fourteen planning steps as summarized in the attached figure-9. The details on the selection of these planning steps are documented in Table-I which includes the following items listed below.

1. The original information systems planning methodology or methodologies from which the particular planning step was selected
2. The criteria used to select this particular planning step

Most of the planning steps in the generic information systems planning model, such as step-3, step-5, step-7 and step-10 etc. are the result of adopting and combining some of the steps outlined in the different information systems planning methodologies reviewed which are identical or relatively similar. Others are determined by adopting one of the steps or combining closely related steps mentioned in one of the information systems planning methodologies such as step-2, step-8, step-11 and step-13. Although the latter steps are mentioned and used in only one of the seven information systems planning methodologies being reviewed, they were selected because of their relatively critical importance and contribution to the overall success of an information systems planning study as mentioned by many MIS experts (12; 20; 21; 27; 28; 29; 30).

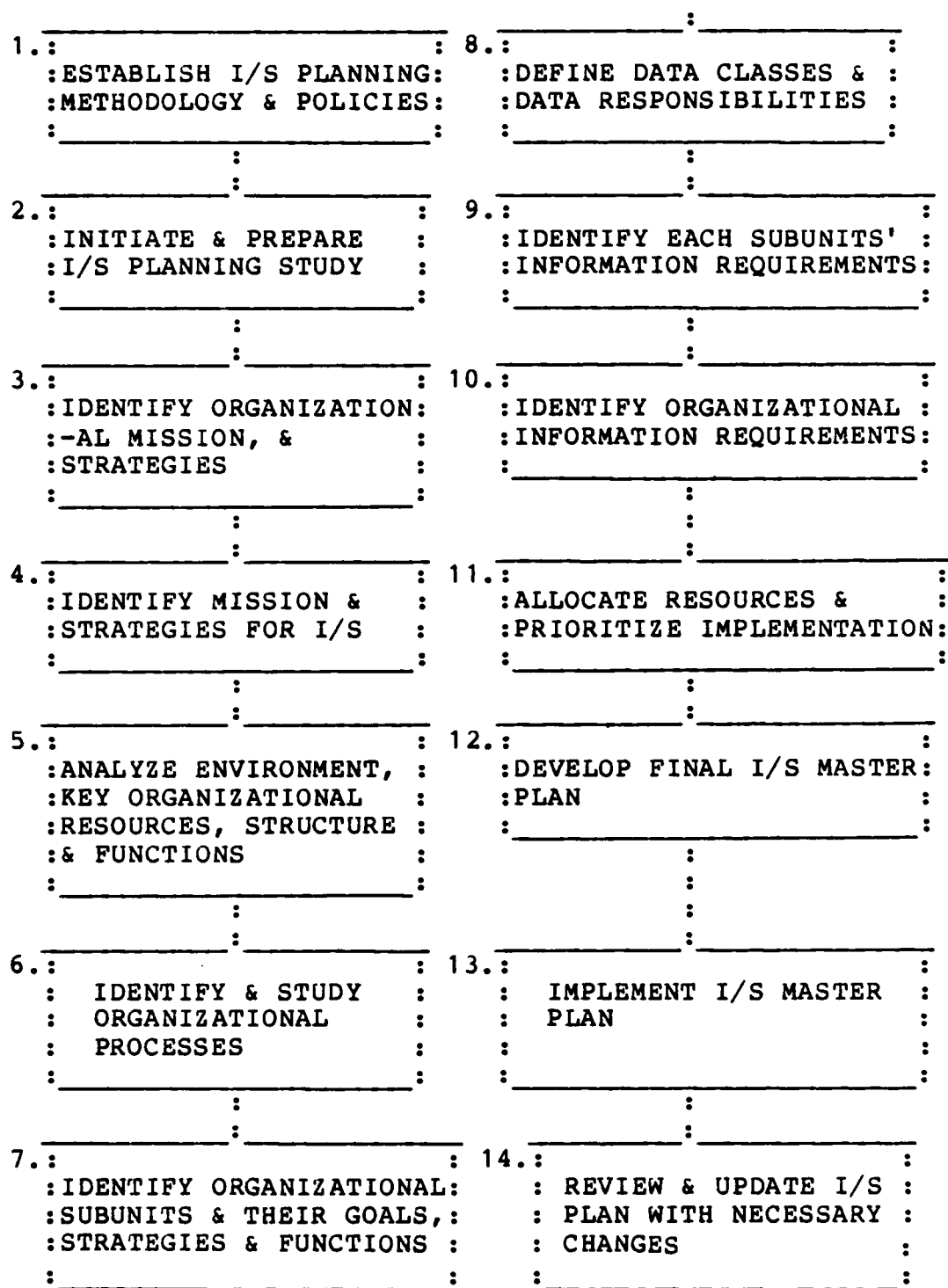


Figure 13. Generic Information Systems Planning Model

TABLE I

Selection of Planning Steps

PLANNING STEP	METHODOLOGIES USING THIS STEP	CRITERIA: USED
1. ESTABLISH I/S PLANNING METHODOLOGY & POLICIES	MCLEAN(5)	2, 3, 4
2. INITIATE & PREPARE I/S PLANNING STUDY	BSP(1,2,3)	3, 4
3. IDENTIFY ORGANIZATIONAL MISSION, & STRATEGIES	BSP(4), THIERAUF(1,2), ISP(1,3)	1
4. IDENTIFY MISSION & STRATEGIES FOR I/S	KING(4), MCLEAN(3,4),	2, 3, 4
5. ANALYZE ENVIRONMENT, KEY ORGANIZATIONAL RESOURCES, STRUCTURE & FUNCTIONS	KING(1), THIERAUF(3), ROCKART(1,2,3,4), COHN(2), MCLEAN(2)	1
6. IDENTIFY & STUDY ORGANIZATIONAL PROCESSES	BSP(5), COHN(3,4), ISP(4)	1
7. IDENTIFY ORGANIZATIONAL SUBUNITS & THEIR GOALS, STRATEGIES & FUNCTIONS	KING(2,3), COHN(1,2), THIERAUF(4), ISP(5)	1
8. DEFINE DATA CLASSES & DATA RESPONSIBILITY	BSP(6)	2, 3, 4
9. IDENTIFY EACH SUBUNITS' INFORMATION REQUIREMENTS	THIERAUF(8), COHN(5), ROCKART(8), ISP(6)	1
10. IDENTIFY ORGANIZATIONAL INFORMATION REQUIREMENTS	ROCKART(6), COHN(6), BSP(7,8,9), ISP(7,8)	1
11. ALLOCATE RESOURCES & PRIORITIZE IMPLEMENTATION:	ISP(9)	2, 4
12. DEVELOP FINAL I/S MASTER PLAN	BSP(10), THIERAUF(5), ISP(10)	1
13. IMPLEMENT I/S MASTER PLAN:	MCLEAN(7)	2, 3, 4
14. REVIEW & UPDATE I/S PLAN WITH NECESSARY CHANGES	THIERAUF(6,7,8), MCLEAN(8)	3, 4

Step-1: Establish Information Systems Planning Methodology and Policies. This planning step is determined using criteria 2, 3 and 4. Although the detailed analysis of the seven information systems planning methodologies shown that it has only been used in the MIS Strategic Planning Framework (37) and Business Systems Planning Methodology (9:484-485; 24), it was frequently quoted in MIS literatures (12; 20; 21; 27; 28; 29; 30). This step is relatively important and necessary because without a proper information systems planning methodology and related policies clearly established within an organization, it will be extremely difficult to develop a good and complete information systems master plan that is relevant to and adequate for the organization's current and future needs.

In order to have a systematic and productive way of carrying out the information systems planning, the organization has to make sure it has selected and established an information systems planning methodology that is best suited for its purposes. Relevant policies governing the conduct of the information systems planning study and the subsequent implementation of the information systems master plan have to be formulated at this step before the commencement of the entire information systems planning study. A well-established methodology and accompanying policies will provide all staff participating in such planning study with a clearer direction and this in

turn can eliminate a lot of unnecessary confusions and wasted time later on during the planning. An organization that has not yet established an information systems planning methodology and policies can engage an external information systems planning consultant who is well-versed with various information systems planning methodologies and tools and can help to train the staff on the methodologies and tools subsequently decided upon.

Step-2: Initiate and Prepare Information Systems Planning Study. From the literature reviews, it would seem that this step is used only in the Business Systems Planning Methodology (9:484-485; 24). It is determined by combining step-2 and step-3 of the Business Systems Planning Methodology (9:484-485; 24) using criteria 3 and 4. This step is important to the success of the entire information systems planning study because it helps the participating staff and planners to avoid unnecessary confusion as regards what is required to be done and what is the output expected from them at the end of the study. It also helps the planning team to obtain a better quality of planning output (24:12).

Basically, this step requires commitment from top management and the other executives in the organization to be established before actually starting the planning study. In fact, most of the important input on organizational missions, goals and strategies and environment would have to

come directly or indirectly from these executives. Other tasks that are required to be carried out under this planning step include the following.

1. Setting up a formal information systems planning steering committee to direct and oversee the entire information systems planning study efforts.
2. Establishing the scope and objectives of the information systems planning study so that all participating executives and the information systems planning study team(s) know exactly what are the various deliverables that they have to produce in each planning step.
3. Selecting a project leader to lead the information systems planning study team and its efforts, to organize and arrange interviews and meetings with top executives and to control and report on the progress of the study.
4. Briefing the study team on the scope and objectives of the study and training them thoroughly on the information systems planning methodology to be used in the study.

Based on the writer's experience derived from his active participation in the first information systems planning study conducted for the Republic of Singapore Air Force, this step could be effectively carried out by appointing a senior executive user in the organization who

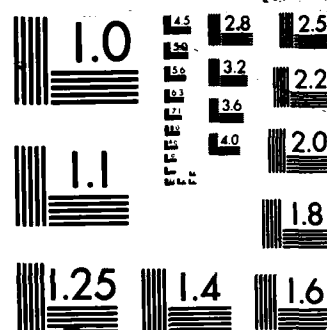
AD-A175 106 THE PROPOSED GENERIC INFORMATION SYSTEMS PLANNING MODEL 2/2
(U) AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH
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knows the organization's operations and functions very well to be the project leader. The project leader would then be required to submit a detailed project charter/plan for the entire information systems planning study to the information systems planning steering committee for their discussion and approval. In the case of the Republic of Singapore Air Force's information systems planning study, the steering committee comprised the entire Air Staff members, senior MIS executives in the defense ministry and some information systems planning specialists and was chaired by the chairman of the Air Staff meeting ie. the commander of the Republic of Singapore Air Force. The involvement of such senior management executives of the organization reflected the organization's total commitment and the support towards the information systems planning study.

The project charter/plan as mentioned earlier was prepared by the project leader of the information systems planning study and included a list of all the necessary resources required such as manpower from both the users organization and from the information systems organizations and the length of time required to complete the entire study. It also proposed the structure and composition of the information systems planning study team as well as the reporting structure of the different sub-teams. A letter from the Chairman of the Air Staff of the Republic of Singapore Air Force to the top management of all the

relevant organizational sub-units involved served to officiate the commencement of such a study and certainly proved to be a most effective way of assisting members of the study teams to gain subsequent support and co-operation from these functional executives.

Step-3: Identify Organizational Mission, and Strategies. As can be seen from Table-1, this particular step was taken from three information systems planning methodologies reviewed, namely the Business Systems Planning Methodology (9:484-485; 24), the Long-Range Planning Model by Thierauf (54) and the Information Systems Planning Methodology used by the Republic of Singapore Air Force (53), using criterion one. It is a common and crucial step for most of the planning methodologies reviewed. Most of the planning methodologies either explicitly or implicitly stated the need to have such a step in an information systems planning methodology in order to clarify the organizational mission, goal(s), strateg(ies) and environment (6; 24; 28; 30; 53; 54).

If an organization already has a well-documented and updated organizational plan which clearly defines its mission, goal(s), strateg(ies), this step will simply require the study team to extract, document, brainstorm and re-examine the relevance of the contents in such a plan to the information systems planning study efforts. If such a plan is absent or is lacking in some aspects, much time and

effort will have to be spent by the study team to gather the needed information in this area. Tools such as the strategic grid (9:457; 34:15; 35) and the strategic fit with organizational culture (9:458; 24) can be used in this planning step to help shape the organizational mission and other components of the organization.

In addition, the 5-step framework for identifying organizational and information system characteristics suggested by Yadav (58:42) can be used by the information systems planners to gain a better understanding of the organization and the information systems to be developed.

Step-4: Identify Mission and Strategies for Information Systems. This step was determined using criteria 2, 3 and 4, and taken from two methodologies, namely the MIS Strategic Planning Process by King (27; 29; 30) and the MIS Strategic Planning Framework by Mclean and Soden (37). Under this step, the information systems planner(s) will need to identify specific statements of mission, goal(s) and strateg(ies) for each of the information systems to be developed. This step is necessary because, when properly carried out, it will ensure that the mission, goal(s) and strateg(ies) of the various information systems will support directly or at least indirectly the organizational mission, goal(s) and strateg(ies) as identified in step-3 above. The tools that can be used in this step are similar to those used for identifying the organizational mission, goal(s) and strateg(ies).

Step-5: Analyze Environment, Key Organizational Resources, Structure and Functions. This is a very common planning step used in most of the seven information systems planning methodologies reviewed. As such, it was selected using the selection criterion-1 alone. Essentially, this step is intended to assist the information systems planner(s) to understand the organization and its information needs by examining the organizational environment, the organization's structure and its key resources and functions performed. Guided by the statements on the mission, goal(s) and strateg(ies) of the organization and the various information systems, this step helps to identify other potential areas of concern that may need information systems support. Other data entities and attributes required by the organization to effectively continue and enhance its operation are identified and documented here as well.

Generally, due to the large amount of data entities and the many attributes within each entity which may be identified here and the subsequent frequent updating of such voluminous data, it is advisable at this stage to start using an automated data dictionary package that can be run on the IBM personal computer or the HP-150 dual-function work station etc.

A look at the key resources and structure of the organization can give the planner(s) to some idea about the

various functions performed by the organization. These functions upon confirmation and re-examination with the user management, would then be used as input to step-6 of this generic planning model which is to identify and study the organizational processes that are necessary to support these functions. The data modeling tool can be introduced at this particular stage to document the many data entities identified and show the interrelationships among them. This data modeling tool has proved to be an effective means for both the users and planners to communicate using the same graphic presentation of their findings or to present their findings to the information systems planning study steering committee. With very little training, even the top management can interpret and understand the results better, that is, the data models and their linkages (53).

Step-6: Identify and Study Organizational Processes.

This step was used in three out of the seven methodologies reviewed, namely the IBM's Business Systems Planning Methodology (9:484-485; 24), the Corporate Data Plan Methodology by Cohn (6) and the Information Systems Planning methodology used by the Republic of Singapore Air Force (53). It was a common step used by most of the process-approach information systems planning methodologies reviewed and was determined using selection criterion-1.

This step identifies the organizational processes which are required to be performed in the organization for

strategic planning, management control and operational control purposes. "No other activities during the study can be quite as overwhelming or as important as identifying the business processes" (24:14). It helps the planner(s) to gain a better understanding of how the organization accomplishes its stated missions and goals (53). The organizational functions identified in step-5 of this generic planning model can be used as the basis for further determination of the organizational processes which may cut across different organizational functions. These processes are important as they form the basis for subsequent executive interviews (to determine the persons to be interviewed and the information requirements of the functions and processes performed by them), the identification of more detailed data entities and attributes and other follow-up activities. Every member in the planning team must have a clear and good understanding of all these processes in order to be able to identify detailed data entities and attributes from them.

The products (or deliverables) to be obtained from this step should include the following items.

1. A brief description of each of the organizational processes
2. A detailed description of the decisions and activities associated with each of the processes
3. Process groups obtained by grouping those

organizational processes with commonalities

The organizational processes and process groups should be identified without regard to the organizational sub-units responsible for performing them. This is important because it can lead to the identification of information systems that are largely independent of sub-units' boundary and therefore are more adaptive to organizational changes. The organizational processes identified here will be used in step-7 of this generic planning model to identify the respective organizational sub-units which are responsible and designated to perform them. The process groups identified here will eventually end up as application systems to facilitate prioritization for implementation (ie, step-11 of this model).

Step-7: Identify Organizational Sub-units and Their Goals, Strategies and Functions. This particular step was determined using criterion one because it was used by four out of the seven methodologies reviewed in this report, namely the MIS Strategic Planning Process (27; 29; 30), the Long-Range Planning Model (54), the Corporate Data Plan Methodology (6) and the Information Systems Planning Methodology (53).

This step relates the organizational processes to the organizational sub-units so as to identify the decision makers who are involved in each organizational process and their degree of involvement in that particular process. The

four commonly used categories of degree of involvement are as follows.

1. Major responsibility
2. Major involvement
3. Some involvement
4. No involvement

Once the area of responsibility of each organizational sub-unit has been identified and depicted, the executive manager of each of the sub-units will then have to specify the goals and operating strategies needed to address all the processes for which he or she holds major responsibility. The sub-units' goals and strategies must support the organization in achieving its overall mission and goals.

The end product of this step comprises the following three items.

1. Statements of sub-units' goals and strategies
2. Definitions of sub-units' processes
3. Organizational sub-unit vs. organizational process matrix that can highlight the following potential problems
 - a. Organizational process which no organizational sub-unit holds the major responsibility
 - b. Organizational process which has more than one organizational sub-unit holding the major responsibility

- c. Organizational sub-unit which is holding major responsibility for too many organizational processes
- d. Organizational sub-unit which is not holding major responsibility for any organizational process

This matrix therefore can be used as a basis for further discussion and clarification between the information systems planner and the user executive manager on the responsibilities of different sub-units within the organization and on the criticality of the many organizational processes evaluated. Those processes that have either no or too many sub-units responsible for them deserve more attention from the top user management. The above four potential problems will have to be resolved before the information systems move on to the next planning steps to identify more details for each of the processes.

Step-8: Define Data Classes and Data Responsibility.

Since data is an important organizational resource just like money and personnel, it deserves special attention. This step is only used in the Business Systems Planning Methodology (9:484-485; 24). It was chosen as a step in this generic planning model based on selection criterion three and four. It was important and required to be included because it reduced subsequent difficulties faced by the information systems planners and/or designers in finding

out who is responsible for what kind of data when they decide to incorporate data requirements in data modeling stage or data base design stage.

This step groups data into logically related categories (24:14). It helps to minimize redundancy in the data bases development and enables future systems to be added without drastic changes to the data bases. It identifies the creators and authorized users of each of the data entities or classes identified for each application system. This in turn provides the foundation both to facilitate the design of data security features required for each application system and the implementation of data administration functions in the organization upon completion of the information systems planning study.

Step-9: Identify Each Sub-Units' Information Requirements. Similar to step-6 and step-7 above, this particular step was selected using criterion one because it was used by four of the seven methodologies examined in this report as shown in table IV-1. The four methodologies that use this step are the Long-Range Planning Model (54), the Corporate Data Plan Methodology (6), the Critical Success Factor Analysis (32; 33; 47; 48; 51; 54) and the Information Systems Planning methodology (53).

In this planning step, each information systems planning study team members from the various organizational sub-units examine the goals and strategies of their

respective sub-units and identify the information which they need to implement their strategies effectively to achieve their goals. Each sub-unit identifies the data entities and attributes which it needs regardless of which organizational sub-units are the creators of these data. All sub-units should not be allowed to modify the definitions and relations of data entities in the initial organizational data model obtained earlier in step-5 of this generic planning model without gaining the prior approval from the entire information systems planning study project team. Otherwise the entire project team will face great difficulty in integrating these sub-units' data model in step-10 of this generic planning model.

The three important products that have to be obtained from this step are as outlined below.

1. Organizational sub-unit's hinged charts to assist the team to check whether each sub-unit's goal and strategy are supported sufficiently by data entities and to see whether there is any data entity that is not supporting any sub-unit's goal and strategy.
2. One data model for each of these sub-units showing all the data entities and the relationships among these entities.
3. A data dictionary for each sub-unit to specify and document the data attributes that are needed in

each data entity for that particular sub-unit.

Step-10: Identify Organizational Information

Requirements. Similar to step-6, step-7 and step-9 above, this particular step was selected using criterion one. It was used by four of the seven methodologies examined in this report as shown in table IV-1. The four methodologies that use this step are the Corporate Data Plan Methodology (6), the Critical Success Factor Analysis (32; 33; 47; 48; 51; 54), the Business Systems Planning Methodology (9:484-485; 24) and the Information Systems Planning methodology (53).

In this step, the organizational information requirements are compiled by integrating the data models of all the organizational sub-units. The end product is a single organizational data model which shows all the information needs of the entire organization in order to achieve the organizational mission and goals through execution of its strategies.

The project team should identify the key organizational sub-unit's data model and integrate it with other sub-units' data model one at a time in order to produce the single huge data model for the organization. As the organizational data model may become too congested, the project team may choose only to show the linkage among data entities but not the kind of data relationship (ie. use only straight line without any branching at both end of this straight line). Upon obtaining the organizational data model, the team can

then proceed to partition this data model into various application systems (organizational process groups) to facilitate the implementation of information systems within the entire organization in phases over a period of time (eg. 3-5 years). The team can go even one step further to identify the portion of each application system which the project team proposes to automate. The recommendations made here are based mainly on the nature of each data entity (eg. data vs. text; formatted vs. unformatted), the size of each data entity (ie. number of attributes and the projected number of entries per day or per week) and its impact on the organizational mission, goals and strategies.

Besides the identification of organizational information requirements, information systems planner in this step has to evaluate the present information systems as well. To evaluate the present operations (both manual and computerized systems) is to assess the adequacies of existing application or information systems by comparing the information provided by existing systems with those data entities identified by the project team for the same applications. The main reasons for doing this are to check the completeness of the data models and organizational processes identified so far and to see what are the necessary changes needed to be incorporated into these data model. The evaluation of present systems can help to identify the data that are either required by users but not

supported by existing systems but not required by users. However, this evaluation does not take into consideration whether the remaining common data (ie. those supported by existing systems and are required by users) are processed in such manners that are in accordance to user requirements and needs. It is therefore not a complete and detailed assessment but rather just to provide sufficient information for the project team to appreciate the general adequacy of these newly identified application systems in the prioritization process later (ie. step-11).

Step-11: Allocate Resources and Prioritize Implementation. Since all the application systems required to support the entire organizational data model can not be developed and implemented at one time, the team has to prioritize them for future implementation and for allocating the limited organizational resources to each of the systems to be developed first. This step was used only in one of the seven methodologies examined namely the Information systems planning Methodology (53) and was selected using criterion two and four. It is important because it helps the planners to clarify a lot of implementation problems and issues which may be faced during the implementation of the information systems planning master plan.

There are different ways to prioritize the application systems for implementation based on the some criteria as determined by the top user management or by the information

systems planning steering committee. A method used by the Republic of Singapore Air Force is to determine the implementation priority using the following four main criteria.

1. Potential benefits
 - a. Tangibles
 - b. Intangibles
 - c. Return on investment
2. Impact upon the organization's operations
 - a. Number of sub-units and people affected
 - b. Qualitative effect
3. Probability of success
 - a. Degree of user acceptance
 - b. Technical complexity
 - c. Pre-requisites for a smooth system implementation
 - d. Length of implementation
 - e. Risks involved
 - f. Resources availability
 - g. Required amount of organizational efforts
4. Demand of a particular system by users
 - a. Adequacies of existing systems
 - b. Effect on accomplishing corporate objectives
 - c. Relationships and interfaces with other systems (eg. does a system has to be ready before the others can be implemented)

d. Political overtakes

e. Needs

The project team may wish to assign different weight to these four criteria to reflect management emphasis and strategies. Another prioritization method suggested in the Business Systems Planning Methodology (9:484-485; 24) is by deciding which of the data bases (or clusters of data entities) are more important to the organization and should be designed and implemented first. Then those information/application systems that extract data from these data bases and provide meaning management summaries to management would be given higher implementation priority.

Step-12: Develop Final Information Systems Master Plan.

This step was used in the Business Systems Planning Methodology (9:484-485; 24), the Long-Range Planing Model (54) and the Information Systems Planning methodology (53). It was selected based on criterion one alone, that is, it was considered frequently or quite commonly used in the seven methodologies being examined.

It consolidates all deliverables from each of the planning steps and compiles them into an information systems master plan for the organization. It also addresses the critical issues of formulating hardware and software strategies and information resource management strategy to support the implementation of this information systems master plan. The other contents that are needed to be

included into the master plan are largely depend on the planning and management emphasis of the particular organization performing the information systems planning study. As a general guideline, the master plan shall include the following items listed below.

1. Information systems planning objectives, scope, methodology used and composition of study team(s)
2. Organizational mission, goals and strategies
3. Organizational information requirements (data model)
4. Problems Analysis on present operations and systems used in the organization
5. Estimated hardware and software configuration;
6. Priority of implementation of all information systems identified
7. Overall implementation time-frame and project schedule for development of each information systems
8. Estimates on the number of information systems specialists and users required to be involved in developing each of the information systems
9. Overall budget estimate required to implement the entire plan

Step-13: Implement Information Systems Master Plan.

This step was only used in the MIS Strategic Planning Framework recommended by Mclean and Soden (37). It is

selected using the Criterion two, three and four. It is important to be included in the generic information systems planning because once the information systems master plan has been completed and approved by higher authority, it has to be executed immediately in order not to lose the drive and momentum gained from the intensive information systems planning study.

One way to carry out this step is to have a branch consisting some of the key members who have involved in the planning study formed to implement the information systems master plan and the information systems policies. This branch will have to report progress of their implementation and difficulties faced by them. The implementation will follow strictly all the priority and constraints specified in the master plan unless otherwise. The implementation staff can request for review of certain portion of the plan at suitable point of time if they see the obvious need for amendments to be made to the existing master plan due to changes in operating environment or user requirements.

Step-14: Review and Update Information Systems Plan With Necessary Changes. This step was proposed by Mclean and Soden in their MIS Strategic Planning Framework (37) as well as by Thierauf in his Long Range Planning Model (54). It was selected using Criterion three and four.

This step makes use of the feedback provided by either the implementation branch and/or other higher authorities.

In any case, the requests for review and update of the information systems master plan have to go through a committee comprises senior management from both the functional organizations and from the information systems community. This committee ensures that the updates and changes to the existing plan are justified and necessary based on certain cost/benefit and overall impact assessment. It acts as a controlling body to make sure that the plan is being constantly reviewed and updated with controlled changes. Also this same committee (which can be the same steering committee for the information systems planning study) can be the one to review the progress of the implementation of the information systems master plan and coordinate the master plan with other critical plan of the organization such as organization's strategic or long-range plan.

Implementation Details and Considerations of the Generic Information Systems Planning Model

To implement or use this generic information systems planning model in the most efficient and effective way, the following implementation details and considerations may be worth the while for an information systems planner to be aware of.

1. Proposed project charter for the information systems planning study

Generally, to kick off the information systems planning study, the chief executive officer (CEO) or the highest organizational management committee requires to appoint a relatively senior executive (vice president and the like) as project leader of the information systems planning study and a senior information systems professional as technical consultant cum/or assistant to this project leader. By appointing a senior and experienced user executive to lead the entire information systems planning efforts can help to ensure user participation and involvement throughout the study. If there is a Chief Information Officer (CIO) already exists in the organization, then this CIO should be the person who have overall responsibility over the information systems master plan (9:540). Depending on the complexity and scope of the study, the two executives may be assisted by one or a few secretaries who perform most of the administrative and technical coordination for the project leaders. Together this initial set-up team of two managers and secretaries, with their combined knowledge and experience can then proceed to work out a proposed project charter/plan for the entire information systems planning study and submit them to highest management committee for discussion, review and approval. This proposed information systems project charter shall include the following items.

- a. Scope of study

This is difficult to be determined even by a very experienced and senior manager alone because of the huge and complex organizational structure and information needs. As a result, it is recommended that the scope of information systems planning study be determined by a group of senior managers (both users and information systems professionals) with relevant knowledge and experience on the organizational functions and information needs and on the technical aspects of information systems planning activities or processes. In this instance, the initial set-up team can decide on the scope of the information systems planning study.

b. Study team structure and members

This proposal has to specify the key functional managers and information systems staff whom the initial set-up team considered necessary and capable to be included as study team members. These functional managers are selected because they are considered to be those who know in detail the functions performed by their respective functional areas as well as the information needs for each of these functions. Upon approval of this project charter, these functional managers who are also the sub-team leader by default are required to set up their own information systems planning sub-teams and to conduct regular information systems planning meetings to deliver the various products/findings to the main information systems planning study team for brain-storming, considerations and integration.

Those information systems professionals who are selected as members of the main information systems planning study team should generally be the more senior, experienced and capable persons especially in the areas of information systems planning study, methodologies and problems-solving. They also need to have good inter-personal communication skills and can deal with different levels of users very well. This is very important since Martin states that users have typically complained about information systems professionals not being able to communicate their ideas well and cannot understand the users' problems and information needs well too (41). A lot of MIS failures in the past were due to the poor inter-personal communication skills of the information systems professionals. For an information systems planning study that covers very large scope, a single study team may not be feasible and practical to cover all the functional areas. Therefore, the project leader and his initial set-up team can divide the organization concerned into relatively autonomous units and propose one information systems planning sub-team for each of these units. A typical example of the information systems planning project structure (with line of command and authority) which was used by the Republic of Singapore Air Force in one of its information systems planning study is shown in Figure-10. In addition, the structure of the information systems planning study project team and the

various sub-teams are shown in Figure-11 and Figure-12 respectively. The number of project members to be included in the information systems planning study project depends on the number of functional sub-units to be covered by the information systems planning study.

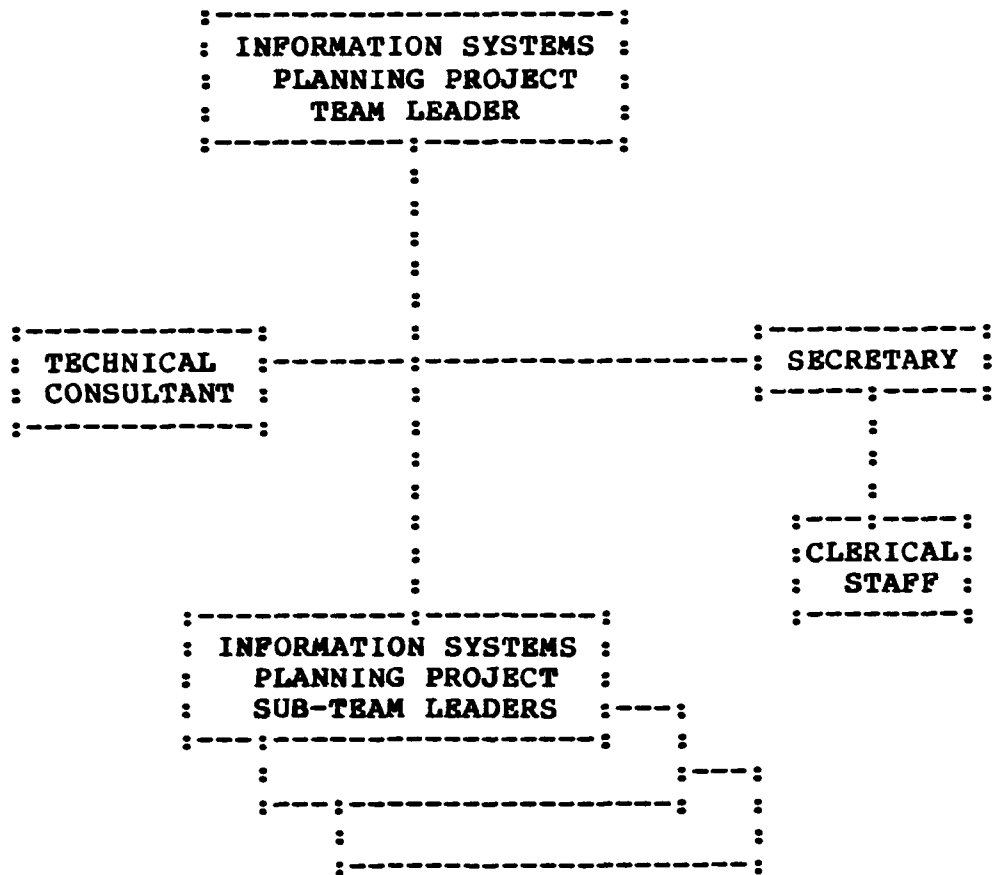


Figure 15. Information Systems Planning Study Team Structure

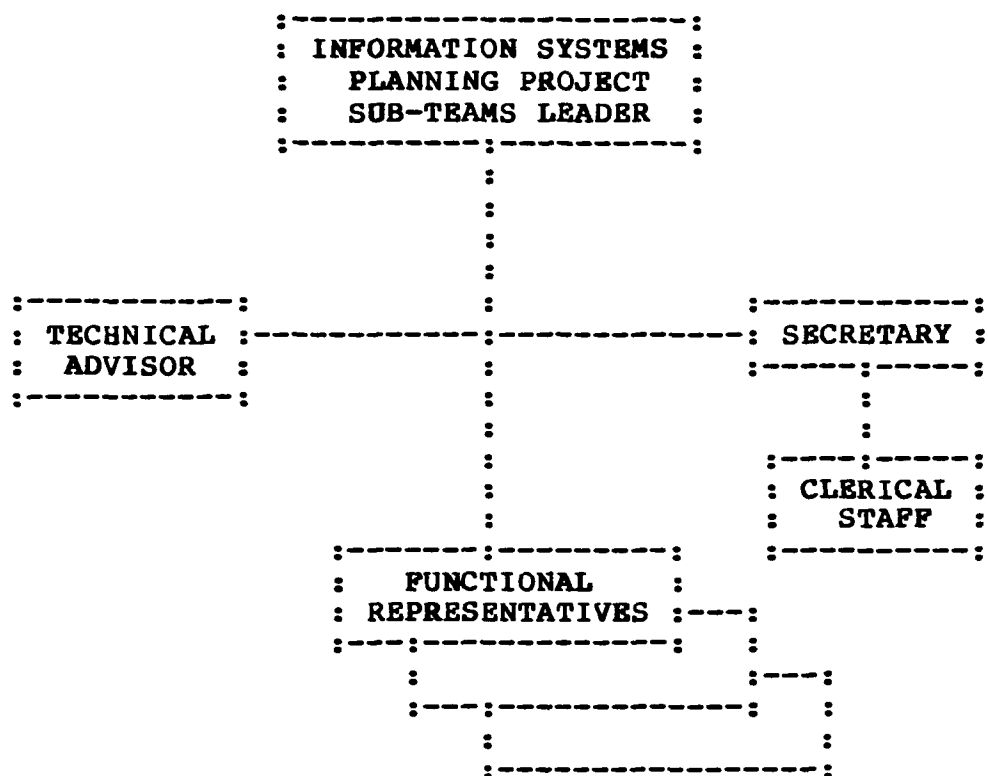


Figure 16. Information Systems Planning Study Sub-Team Structure

c. Roles and tasks for each of the information systems planning team members

The proposed project charter shall lay down in precise term, all the required tasks and roles that each participating team members in the information systems planning study need to do. Specifically, they should be attached as appendix to the project charter and include the following committee and appointments for the information systems planning study project.

1. Steering committee
2. Functional group steering committee
3. Project leader
4. Project member cum sub-team leader
5. Project team secretary
6. Project sub-team members
7. Sub-team secretary
8. Technical consultant to project leader
9. Technical advisor to sub-team leader

The roles and functions of each of the above nine categories of persons and committees are given in Appendix-A to Appendix-I of this report.

d. Information systems planning study project schedule

Together, the information systems planning initial set-up team can chart out a rough information systems planning project schedule laying down the estimated dates for each of

the planning steps and their deliverables to be completed and the suitable check points for information systems planning steering committee to review and approve. This first-cut schedule will most likely subject to changes later when the entire information systems planning study project team and the various sub-teams have been formed and have kicked off their information systems planning meetings. This will be so because a more realistic and accurate estimate can then be fed to the project leader for review of his project schedule for the entire information systems planning study.

e. Brief executive presentation of information systems planning methodology to be used

The executive summary aims to provide an overview of the philosophy and characteristics of the specific planning methodology selected so that they can know the extent as to the level of details to be covered and the deliverables from the particular tool. Based on the experience of the Republic of Singapore Air Force study, management commitments and support can be easily obtained after such a presentation to the top management and steering committees (both information systems planning committee and the functional information systems planning committees). In addition, such presentation gives the top management and the committees an insight into how much efforts are required from the entire organization in terms of time, manpower and

financial resources in order to complete the information systems master plan. The committee can then decide whether they and their organization can and will be able to commit such an amount of resources on the information systems planning study. This is necessary because most of the key personnel involved in the information systems planning study have to work almost full-time on the information systems planning project and be off-loaded from their functional duties temporarily.

2. Conduct training to all personnel involved in the study on the information systems planning methodology and other relevant planning concepts and tools

This is a very important step that has to be carried out properly and thoroughly before the commencement of the entire study. This is because without a good understanding of the planning methodology, tools and concepts, the team members can not fully apply each of the planning steps to identify and document all the relevant information needs of his particular functional area. The member cannot appreciate the purpose of each of the planning steps and the interrelationships and linkages among the deliverables obtained from each of the planning steps. One point to note here is that, a short (about two hours) presentation of the information systems planning overview to functional steering committee which includes all relevant key functional

managers and chaired by the functional chief by either the sub-team leader or the technical advisor to sub-team leader can help to ensure better commitment, support and understanding from these managers when the sub-team requires their and their staff's participation and input.

3. User involvement/participation

As mentioned earlier, both the CEO and the information systems planning steering committee has to be aware of the tremendous efforts and time that each member has to put into the information systems planning study in order to come out with the information systems master plan. For an information systems planning study that covers very large scope and depth, the team members should meet very often if not full-time on the project initially. From the beginning of step-1, only the members of the main information systems planning study team led by the project leader have to meet very regularly (at least three time a week and three to four hours per time) in order to identify the organizational mission, goals, objectives and the strategies to achieve each of these objectives. These deliverables can then be brought back to individual sub-teams by their respective sub-team leaders who are also member of the main study team. The sub-team can then start their regular meetings to identify their respective functional goals, objectives and operating strategies which are consistent with and support those of the organization's. They therefore will have to

involve from step-5 (i.e. to analyze their respective functional organizational structure, the environment, the key resources and the activities their organization performed) onward of the generic information systems planning model.

It is important to note here that the information systems planning study should not be the sole business of the MIS department and their staff. It is a joint team effort by both the users and the information systems staff. In fact, the Republic of Singapore Air Force study was driven by users and they are the one who perform most of the steps covered by the existing information systems planning methodology. Similarly, the generic information systems planning model requires user to drive the study with the technical guidance from the technical consultant or advisors because one of its basic philosophy is user-driven.

4. Set up information systems planning study control file

Since there will be a lot of deliverables submitted to members of either the steering committee, main project team or the sub-teams for review and integration, there is a clear need for an information systems planning project progress and control file to be set up to contain all these planning deliverables. Also, this control file helps the team leader to keep track of every deliverables of each of the planning steps that different sub-teams have to submit

for integration at his meeting (24). The control file at sub-team level can serve the same purpose by helping the sub-team leader to monitor the deliverables that he should receive from each of his sub-team members representing various functional areas.

5. Establish clerical/administrative support (24)

Typing, copying, re-drawing and other word-processing support will be heavily required by all the study teams and should be estimated and organized before the commencement of the study. For instance, the DATADICT package, an automated data dictionary software running on IBMPC and HP150 micro-computer might be purchased and made ready for use by every information systems planning study team and sub-teams so that the up-to-date compilation of all data identified will not be the task that delay or postpone meeting dates. This package can help the secretarial or administrative staff to sort, link data entities with same search key, and perform all kinds of editing functions on the data definition and contents.

At the same time, the format for each deliverables and the abbreviation used for common terms such as "COMP" for component, "#" for number etc. have to be standardized and made known to all members involved in the study by the secretaries who has responsibility of maintaining data format and abbreviation consistency. Certain matrix tables formats and deliverables' samples/outline for instance;

units vs. processes, managers vs. data responsibility etc. can be prepared and made available for each sub-team member to use or follow since drawing of such matrices by each team and try to come out their own format/layout are not a productive use of time and effort.

6. Predetermine progress checkpoints for the planning study

The project charter should also include an item to list all the relevant checkpoints that the project leader would like the steering committee to meet as well as the dates that he wants to review the progress and findings of each of the sub-teams in order to keep all teams up to the same speed. Each sub-teams leader with the help of his technical advisor will then have to give presentation on their findings up to the checkpoint-date to the project team leader and their respective functional steering committee. Upon reviewing all the progress of each sub-teams and integrated their findings, the project leader of the main information systems planning study team will then has to present the total findings to the steering committee above him. Review of organizational mission, goals and strategies with the CEO will have to carry out frequently by the project leader even before the formal presentation.

Possible Applications of the Generic Information Systems

Planning Model

The generic information systems planning model shall include the fourteen basic steps depending on the needs, planning emphasis, nature and complexity of an organization and the organizational environment (5; 6; 12; 14; 15; 16; 22; 24; 35; 49; 52). For instance, if the organization concerned is a complex one that operates in dynamic and complex environment, the highest level of corporate mission may not be readily available and it will not be easy to identify it. If the information systems to be developed are relatively important to the survival of the organization, then there is the need to tie the information systems planning closely to support the corporate mission (12). The information systems planner in this case, has to interview and consult the top management in order to ensure that all the future needs and projected changes to the organization are being considered.

In the case of the planning for an information system that is less critical to (or has less impact to) the entire organization and its operation, the information systems planner may be able to skip the step of defining the highest level corporate mission and the study of the entire corporate environment. He or She can in fact start the planning study by setting only the information systems planning objectives and objectives of those information

systems and the related business units. The planner need not have to tie the information systems planning to the corporate or strategic planning of the organization in this particular instance (12; 53).

Since the generic information systems planning model includes planning steps that meant for the strategic planning and the long and short-term planning on information systems requirements and other related issues, it is most relevant for information systems planning studies that are of larger scale and bigger scope. As mentioned earlier, for information systems planning on relatively small number of information systems, some of the planning steps can be skipped or perform to a lesser extent. To further clarify the different application of the generic information systems planning model, the following scenarios were created together with some specific instructions on the application/usage of the generic information systems planning model.

1. Scenario #1

This involves large scope of information systems planning study that covers all possible functional areas that are feasible for computerization. Organization in this case, is a large, complex and dynamic one which faces great uncertainty in its day-to-day operation (e.g. large R&D firms, government research agencies and big multi-national corporations etc.).

For organizations that fall under this category, all the steps in the generic information systems planning model have to be properly carried out in detail. The information systems to be developed have to play the role of providing relevant management information so as to reduce the great uncertainty faced by the organizations in this case.

Specifically, intensive and well-planned training for all people who will be involved in one way or the other in the information systems planning study. Since many different functional areas are involved in the study, step-2 (i.e. initiate and prepare for information systems planning study) has to be properly planned and systematically carried out by a relatively senior user executive with the help from one or more senior information systems executives acting as his technical consultant(s). Many information systems planning sub-teams should be formed to look into each of the functional areas. A lot of co-ordination and integration effort are required because of the different information requirements for the many functional areas.

Step-3 and step-4 of the generic information systems planning model (i.e. identify and define mission, goals and strategies for the organization and for the information systems), have to be constantly reviewed throughout the entire study period in order to ensure that the information systems' mission, goals and strategies are compatible with and in support of the organizational mission, goals and

strategies. Step-5 to step-7 (i.e. analyze environment, identify and study organizational processes, identify organizational sub-units and their goals, strategies and functions) will have to be carried out by individual information systems planning sub-teams separately from the main study team. Once each sub-unit's information requirements has been identified and approved by their respective functional information systems planning steering committee (i.e. completion of step-9 of the generic planning model), it is then left for the main information systems planning study team (only one in any kind of organization) to integrate these different functional information requirements into a single organizational information requirements (i.e. step-10 -- identify organizational information requirements) using the data model. The details of the information contained in this organizational data model have to be documented using the data dictionary notation (defined in the operational definition section in chapter I).

If there are existing information systems in operation within the organization, then step-11 (i.e. evaluate present information systems and allocate resources and prioritize implementation) has to be performed in detail according to some predetermined management priorities and constraints. Step-12 to step-14 (i.e. develop final information systems master plan, implement information systems master plan and

information systems policies, review and update information systems plan with necessary changes often) of the generic information systems planning model are rather standard practice for different kind of organizations.

2. Scenario #2

This refers to small scope of study in a relatively small organization which exists in a stable operating environment with few functional areas and faces little uncertainty (e.g. small private business firms, individual-owned bookstores and grocery stores etc.)

Organizations under this particular scenario can afford to spend less time and effort on step-1 and step-2 of the generic information systems planning model because the small study scope and the small number of functional areas covered by the information systems planning study. Since only one study team alone may be sufficient to handle all the necessary planning activities, the training on the generic information systems planning model can be conducted informally and should be confined only to the team members in the study team. No proper, systematic and extensive planning and initiation of the information systems planning study is required in this instance.

As for step-3 and step-4, if the organizational mission, goals and strategies have already been established and in practice for quite some time (due to the stable environment that the organization is in with little

uncertainty), then step-3 can be skipped and step-4 can be carried out with less review subsequently throughout the entire study period as compared to the scenario #1 case. If there is no readily available organizational mission, goals and strategies, then performed step-3 and step-4 as in the case of scenario #1.

Unlike the case of scenario #1, the remaining step-4 till step-14 of the generic information systems planning study will all be performed by the single information systems planning study team since there is no other information systems planning sub-teams formed in this instance to look into the individual functional areas.

Potential Advantages and Disadvantages of the Generic Information Systems Planning Model

Compared to other information systems planning methodologies reviewed in this thesis, the proposed generic information systems planning model can be expected to provide the following advantages to organizations (especially the large ones) which applied it.

1. Provide a mechanism by which organization can establish and initiate an information systems planning study and establish necessary MIS policies to govern the information systems identification, development, implementation and the information resource management (step-1 & step-2).

2. Enable users to constantly relate their information requirements to the overall organizational mission, goals and strategies. The proposed generic information systems planning model is an objective-driven one which ensures that the information systems objectives and strategies are closely linked to and in support of the organizational mission, goals and strategies. This, in turn, ensures that the information systems master plan developed will support and be compatible with the organizational master plan (step-3 & step-4).
3. Provide specific planning tools such as processes vs. sub-units matrix, data model, data dictionary, mini-specification (or called MINI-SPEC), and data flow diagram (10) etc. for the information systems planners to perform the following tasks:
 - a. Examine the organizational environment by examining the organizational mission, goals, strategies, product and services etc. (step-5);
 - b. Identify the key and supporting resources, planning and control requirements and derives the complete list of processes required to be performed by the organization (step-6);
 - c. examine the allocation of responsibilities and the sub-units' objectives and operating strategies (step-7); and

- d. Package the organizational processes into information systems and identify the data model for each of these information systems to highlight the sharing and flowing of data among information systems (step-8 & step-9).
4. Provide integration technique for the main information systems planning study team to use to combine and integrate various sub-units' information requirements in the form of data model into a single organizational data model which documents the entire information needs of the organization and highlights the sharing and flowing of data among the different sub-units (step-9 & step-10).
5. Facilitate the top management to decide on the implementation priority by examining the predetermined criteria (impact, degree of complexity, cost saving etc.) in order to produce and ensure up-to-date information systems master plan (step-11 to step-14).
6. Encourage active user participation and strong management commitment from the beginning till the end since this model is a user-driven one in which users lead all the information systems planning study team(s) and activities.
7. Help the planning team to identify more stable

information systems since the identification is done using the stabilized, consolidated and integrated data model which is less changeable than the procedures and/or processes that are using these data and mirrors the organizational information needs.

The disadvantages of the generic information systems planning model include the following.

1. This model required most of the sub-units' functions and information to be finalized before going into the information identification activities and therefore may not be suitable for organizations undergoing major reorganization. This is so because if the sub-units' objectives, strategies and functions could not be clearly defined and confirmed, the subsequent planning steps (from step-8 to step-14) of the generic information systems planning model would be carried out based on the uncertain sub-units' objectives, strategies and functions. The planning team members may not feel so committed and be motivated since they know that their effort may lead to no where and be wasted. Preferably, this model should be used upon completion of the re-organization process (if any) of an organization.

2. This model may not be an effective planning methodology for organization that is geographically split into many far and remote locations. This is because such an organization may face long travel time and required more coordination effort to use this model.. As a result, not too many meetings and interviews (which are the primary means of gathering information requirements for developing the information systems master plan) can be conducted by the entire information systems planning study teams and the application and implementation of the generic planning model may face higher risk of failure.
3. The integration of information requirements of many diversified and autonomous sub-units into an organizational information architecture (i.e. corporate data model obtained in step-10 of the generic planning model) becomes extremely difficult if not impossible when the number of sub-units with autonomy in decision making and in pursuing their own product lines/services increases to a large number in an multi-national corporations.

V. Recommendations & Conclusions

This final chapter covers four areas, namely, the potential areas of improvements, the recommended information systems planning guidelines, the recommendations for future possible research and the conclusions that can be made based on the findings of this thesis study.

Potential Areas of Improvements

At this juncture, it is difficult to identify all the possible improvements to such a planning model which is not field-tested in real world environment. However, some of the relatively obvious enhancements could be made to the generic information systems planning model if time and other resources permit.

1. Create a more complete and flexible set of criteria for the information systems planning steering committee and planners to use to rank, prioritize the many information systems identified and to allocate the information resources among these information systems supporting different functional sub-units.
2. Automate more of the clerical support tasks which occupied a lot of the planners' times. The automated data dictionary package is only one of the good example in which automation can help to speed up the planning teams' progress. Other areas

that can be automated include the drawing and modifications of data flow diagrams, decision and organizational charts and preparation of slides for management presentation and review by the steering committee. Intelligent work station with integrated word processing and graphic tools and some preliminary expert systems that provide "what if" type of questions should be purchased and made readily available for planners to enhance their productivity.

Recommended Information Systems Planning Guidelines

Study done by Rhyne showed that organizations conducting strategic planning gave increased attention to future oriented external and environmental factors (46:10). Therefore, information systems planners should take note of this and examine the organization's external and environmental resources and factors thoroughly in order to identify all the necessary information requirements.

The following are some of the more important, applicable and relevant guidelines for conducting the information systems planning in an organization. They might be used together with the implementation considerations discussed in chapter-IV by the information systems planners (37:76-77) in order to ensure a better chance of success in their information systems planning study.

1. Develop formal planning procedures to define precisely the steps in the information systems planning process
2. Define specific objectives of the information systems planning effort right at the beginning and then focus subsequent planning efforts towards achieving these objectives
3. Obtain top management support and approval on the following items before embarking on the detailed information systems planning tasks, namely, to identify:
 - a. Organizational mission, objectives, strategies and key resources for the overall organization
 - b. Information systems objectives and strategies which support the organizational goals and objectives
 - c. The set of information systems policies regarding the organization, allocation and use of MIS resources by various sub-units in the organization
4. Use the overall organizational plan , if present and available, as a basis (starting point) for and input to the MIS planning effort
5. Tie the MIS plan to such an overall plan to ensure that it will meet all critical information needs of the organization and its management

6. Have plans to review the justifications and benefits of modifying existing systems rather than developing entirely new systems
7. Develop means with objective selection criteria by which management is able to evaluate and determine priorities for the undertaking of new application or information systems
8. Communicate actively and regularly with top management and other persons in the organization regarding the MIS planning effort so as to secure their understanding and support
9. Be knowledgeable and well-informed on the literature regarding the overall organizational planning and the information systems planning experience of other practitioners in the field as well as the specific information systems planning approaches or methodologies adopted by the organization

Recommendations for Future Possible Research

The generic information systems planning model can assist information systems planners and project leaders (managers) to perform their high-level information systems planning. The information systems master plan, the end-product of such a planning study, can be used as a good basis and starting point for various information systems

development teams to develop their respective detailed project schedules and control charts.

The generic information systems planning model can be incorporated into a complete and total software development life cycle methodology package as the first phase methodology to support the information systems professionals in carrying out their information systems and project planning. Future research can be directed to packaging similar structured (top-down) methodologies to support subsequent information development phases such as the systems analysis and preliminary design, the program/database design and systems implementation and the operation and enhancement. These methodologies should preferably make use of the various products obtained upon applying the generic information systems planning model in order to save some information systems development time.

For instance, the data models developed using the data modeling technique in the generic information systems planning model can be further enhanced by incorporating more detailed data elements during the systems analysis phase when the systems analysts have carried out their intensive interviews with the users. This can save a lot of analysis time provided that the systems analysts use the information analysis methodology which applies the data modeling technique and the data flow diagram.

The brief overview of how the generic information systems planning model can fit into such a total and structured software development life cycle methodology package are shown in Figure 17 using the data flow diagram notation. It can be used as the first methodology package in the information systems planning stage before other methodologies such as the the Information Analysis Methodology (1; 9), the Structured Analysis Technique (10) and the Structured Analysis and Design Technique (57).

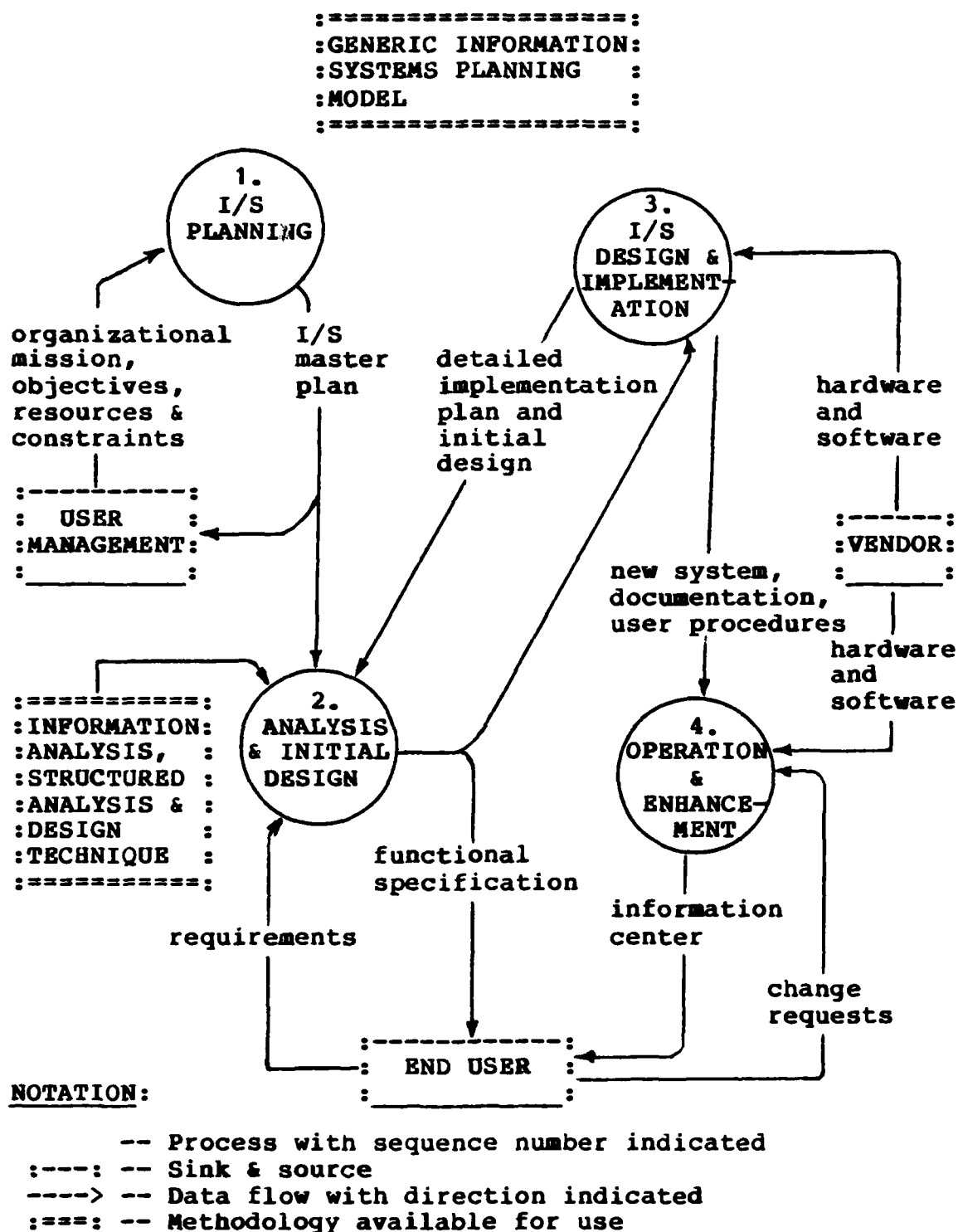


Figure 17. Total Structured Software Development Life Cycle Methodology

As for the Republic of Singapore Air Force, the proposed generic information systems planning model can be used to compare with the existing Information Systems Planning Methodology used in most of the information systems development projects in the Republic of Singapore Air Force.

A constructive but very difficult way to do this is to compare the end results of two similar information systems development teams in which one uses the generic information systems planning model and the other uses the existing Information Systems Planning Methodology. Thereafter, necessary modifications can be made to both planning methodologies. The synthesis of these two enhanced planning methodologies represents a more adequate and probably a better information systems planning methodology for the Republic of Singapore Air Force.

Conclusions

In summary, this thesis report documented many experts' views on the issue of information systems planning. It also included the review of several commonly suggested and used information systems planning methodologies. Majority of the effort was spent on the development of a generic information systems planning model by synthesizing the relevant steps used in those planning methodologies reviewed.

The generic information systems planning model need to be applied in real world environment successively in order

to gather the necessary feedback data from its users on its possible weaknesses. Further enhancements can be incorporated into this model to make it a standard information systems planning methodology for use in a total software (information systems) development life cycle methodology package. It will require intensive research and effort in order to come out such a total methodology package. However, the potential benefits from using such a total software development methodology package promise to be much greater than those gained from the individual methodology such as the proposed generic information systems planning model, the Information Analysis Methodology (1; 9), the Structured Analysis Technique (10) and the Structured Analysis and Design Technique (57).

Appendix A

Roles and Functions of the Information Systems Planning Study Steering Committee

1. Set direction and constraints for the information systems planning study teams to follow throughout their study period
2. Review periodically the progress of the information systems planning study project and to approve any deviations or changes to the study project schedule when necessary
3. Approve the information systems master plan developed by the study team with particular attention on the prioritization of various information systems for implementation, the allocation of information systems resources among different functional areas and the computer hardware and software configuration and strategies
4. Steer the entire information systems planning study effort from the beginning till the end and keep the information systems master plan up-to-date through periodic reviews

Appendix B

Roles and Functions of the Functional Group's Information Systems Planning Study Steering Committee

1. Review and approve the findings of its respective information systems planning sub-team pertaining to the statement of goals, strategies, functional responsibilities and the processes performed and information requirements
2. Provide important feedback and opinions to the central information systems planning steering committee and its respective information systems planning sub-team as regard to planning constraints and specific study requirements and emphasis
3. Ensure the information systems planning sub-team receives adequate support and co-operation from all the relevant sub-units within the functional area
4. Make decision as regard to slippage in information systems planning project schedule and difficulties encountered in gathering accurate and reliable information requirements

Appendix C

Roles and Functions of the Information Systems Planning Study Project Leader

1. Conduct regular information systems planning team meetings to consolidate and integrate information requirements gathered by different sub-teams for various functional areas
2. Review and examine information requirements submitted by all the sub-team leaders (who are also the project members of the main study team) for their respective functional areas
3. Present the information systems findings to the information systems planning study steering committee at pre-determined check points for review and approval
4. Keep top management informed of the progress, problems and difficulties faced by the study teams
5. Ensure every sub-team is following the schedule and are conducting its respective regular meetings to gather necessary information requirements to be integrated at the information systems planning project team level

Appendix D

Roles and Functions of the Information Systems Planning Study Project Member Cum Sub-Team Leader

1. Participate in the information systems planning team meetings as a regular member to articulate and present information requirements of his or her respective functional area
2. Receive overall information systems planning study guidelines and schedule from the information systems planning study project leader and work out a more detailed one for his or her respective information systems planning study sub-team for execution
3. Keep both the functional group's information systems planning steering committee and the information systems planning study project leader informed of his or her respective information systems planning study sub-team's progress
4. Submit findings of his or her respective information systems planning study sub-team to functional group's information systems planning steering committee for review, discussion and approval before bringing it to the (central) information systems planning study project team meetings for consolidation and integration with findings submitted from the other information systems planning study sub-teams

5. Conduct regular information systems planning sub-team meetings to consolidate and integrate information requirements gathered by different sub-team members for their respective areas of responsibility

Appendix E

Roles and Functions of the Information Systems Planning Study Project Team Secretary

1. Provide necessary clerical and administrative support to mainly the (central) information systems planning study project team with secondary responsibility (through the sub-team secretaries) to ensure that all the information systems planning study sub-teams receive adequate and standardized clerical and administrative support
2. Assist the information systems planning study project leader in arranging management presentations for the information systems planning study steering committee and information systems planning study team meetings
3. Ensure that all documentation standards for the final information systems master plan are being made known to and adhered by all planning study sub-teams
4. Assist the information systems planning study project leader in consolidating and summarizing the findings submitted by the various planning study sub-teams
5. Assist the planning study project leader in coordinating and monitoring the progress of the various planning study sub-teams

Appendix F

Roles and Functions of the Information Systems Planning Study Project Sub-Team Member

1. Participate in the information systems planning study sub-team meetings as a regular member to articulate and present information requirements of his or her respective area of responsibility
2. Submit necessary information requirements and documentation to the information systems planning study sub-team leader for discussion among all the sub-team members and for initial consolidation of sub-team information requirements for submission to the central information systems planning study project team
3. Brief and seek approval from his or her respective superior on the information requirements findings before submitting them to the information systems planning study sub-team leader for discussion and consolidation

Appendix G

Roles and Functions of the Information Systems Planning Study Project Sub-Team Secretary

1. Provide necessary clerical and administrative support to all the members in the information systems planning study sub-team
2. Ensure that all the sub-team members understand and follow the information systems planning study guidelines and documentation standards
3. Assist the information systems planning study sub-team leader in arranging management presentations for the functional group's information systems planning study steering committee and information systems planning study sub-team meetings
4. Assist the information systems planning study sub-team leader in consolidating and summarizing the findings submitted by the various information systems planning study sub-team members

Appendix B

Roles and Functions of the Technical Consultant to Information Systems Planning Study Project Leader

1. Provide technical advice to the information systems planning study project leader on the conduct and application of the various information systems planning steps
2. Assist the information systems planning study project leader in ensuring that the information systems planning meetings are being carried out in the right direction with meaningful and acceptable results
3. Assist the information systems planning study project leader in presenting the technical aspects of the information systems planning findings to the information systems planning steering committee
4. Monitor the service given by the technical advisors assigned to the various information systems planning study sub-teams and assess their performance throughout the information systems planning study period
5. Conduct regular review meetings with the technical advisors under his or her assessment to resolve difficulties and problems faced by the technical advisors and to reinforce standardized and consistent

advice being given to every information systems
planning study sub-teams

6. Assist the secretary to the information systems
planning study project leader in arriving at a set of
comprehensive and applicable documentation standards

Appendix I

Roles and Functions of the Technical Advisor to Information Systems Planning Study Sub-Team Leader

1. Provide technical advice to the information systems planning study sub-team leader on the conduct and application of the various information systems planning steps
2. Assist the information systems planning study sub-team leader in ensuring that the information systems planning meetings are being carried out in the right direction with meaningful and acceptable results
3. Assist the information systems planning study sub-team leader in presenting the technical aspects of the information systems planning findings to the respective functional group's information systems planning steering committee
4. Assist the secretary to the information systems planning study sub-team leader in ensuring that all the documentation standards for the final planning findings are being adhered to strictly by every sub-team members
5. Provide constant feedback to the technical consultant for planning study project leader on the progress and problems faced by the respective study sub-team

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VITA

Major Lai Kim Fatt was born on 11 November 1956 in the city of Singapore, Republic of Singapore. Upon graduation from the National Junior College of Singapore in 1974, he served about seven months of the compulsory 2-year draft period before being selected by the Ministry of Defense to pursue a Bachelor degree course in Civil Engineering in the National Defense Academy of Japan. After graduation in March 1980, he attended a seven-month military officer conversion course at the Officer Cadet School of the Japan Ground Self Defense Forces. He returned to Singapore in October 1980 and was appointed the project engineer to assist the Assistant Chief of General Staff (Logistics). He was later transferred to the Systems & Computer Organization of the Ministry of Defense in September 1981 to work as a Systems Engineer. He also acted as the Project Manager for the computerization of the Supply systems for the entire Republic of Singapore Air Force. In September 1983, he was appointed as Head, Air Force Logistics Computer Center, an appointment he held until he entered the Air Force Institute of Technology in June 1985.

Permanent address: 26, Limau Walk (Kew Cottages)
Singapore 1648.
Republic of Singapore

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The need for a better information systems planning methodology for use in the Republic of Singapore Air Force prompted this thesis effort.

This thesis report focuses on the development of a generic information systems planning model that is applicable to different organizations. Such a model is being developed by reviewing in detail, seven different information systems planning methodologies commonly used at present by many government and business organizations and thereafter, synthesizing them based on some selection criteria. The later part of this report documents details of each of the fourteen planning steps in the proposed generic information systems planning model. The potential advantages, disadvantages and possible applications of this model are also addressed and documented.

The thesis report is concluded by recommending possible field testings and future research to further enhance and refine the proposed generic model. It is hoped that a better and more complete information systems planning methodology for the Republic of Singapore Air Force can be developed from the proposed generic model to ensure a compatible and integrated information systems network for the Republic of Singapore Air Force in the near future.

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